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LAS VEGAS GRAPHIC STUDY.(U)
JAN 78 J J MAURER, V J MISIEWICZ, R W TACK

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LAS VEGAS GRAPHIC STUDY

John J. Maurer
Victor J. Misiewicz
Robert W. Tack

JANUARY 1978

FINAL REPORT

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NOTICE

METRIC CONVERSION FACTORS

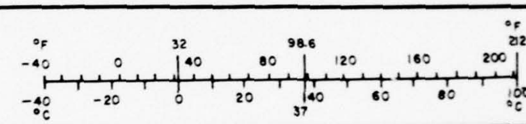
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



9 Final rept.

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16. Abstract

A graphic study was conducted by the National Aviation Facilities Experimental Center (NAFEC) to develop and evaluate a number of new procedural plans for the control of air traffic operating within the Las Vegas terminal area. A plan was also developed for a "head-on" type departure/arrival operation for Nellis Air Force Base (AFB). A controller opinion questionnaire was developed around factors that comprise elements of air traffic control that take into consideration the users, controllers, and the area. Each plan was evaluated by a panel of 14 air traffic control specialists. The new plans for the terminal area, along with the present operating procedures, were evaluated for each of four directions of operation or runway configurations and then statistically compared with each other. The "head-on" plan for Nellis AFB was likewise evaluated, and results from the questionnaires statistically compared with present operating procedures at Nellis AFB. The results of the evaluation indicate that, overall, plans 1 and 2 were significantly preferred over the present system and plan 2 was also significantly preferred over plan 1. The present system at Nellis AFB was significantly preferred over plan 3 (Head-On Procedures). Basic reasons for the raters' choice of the Nellis present system over the head-on procedure were safety, complexity of operation, controller workload, and adverse effects to missions at Nellis due to delays.

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PREFACE

This study was conducted by the Systems Test Branch, ANA-110, under the auspices of the Air Traffic Control Operational Sustaining Engineering Program, SE-191. The Subprogram manager was Mr. Joseph O'Brien, ARD-150, and the National Aviation Facilities Experimental Center (NAFEC) Program Manager was Mr. Felix F. Hierbaum, Jr., ANA-110.

Appreciation is expressed to Messrs. Donald Davis, Robert Young, Stewart Hayter, and other members of the Western Region Headquarters, Las Vegas Terminal Facility, Los Angeles Air Route Traffic Control Center, and the air traffic control personnel from Nellis Air Force Base, for their willingness, cooperation, and contributions to the efforts of this study.

TABLE OF CONTENTS

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LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

PURPOSE.

The purpose of this project was to develop and evaluate a number of new procedural plans for the control of air traffic operating within the Las Vegas terminal area. The specific objective is to compare various newly developed procedural plans to present air traffic control (ATC) operation within the Las Vegas terminal area.

BACKGROUND.

An Air Traffic Control Staff Assistance visit to Nellis Air Force Base was conducted by the United States Air Force (USAF) during the period of January 19 through January 24, 1976. The purpose of the visit was to evaluate ATC procedures utilized by Las Vegas Approach Control and Nellis Air Force Base (AFB), with special emphasis on the preferred calm-wind runway operation.

Although in-depth ATC studies had been completed of the Las Vegas area, the report, which was written upon the conclusion of the staff visit, recommended that continuing efforts be made to study and develop more efficient procedures for utilization at McCarran, Nellis, and other airports in the Las Vegas Valley. A recommendation was made that a dynamic simulation of the area be conducted at the National Aviation Facilities Experimental Center (NAFEC), to assist in this end.

A meeting was held with representatives from NAFEC, the Western Region, Las Vegas terminal facility, and the USAF in Las Vegas during the month of April 1976. At this meeting, the participants were afforded a detailed briefing by NAFEC personnel describing both the dynamic simulations and graphic studies. In July 1976, the Western Region submitted a request through the Systems Research and Development Service (ARD-150) indicating that after considerable study of the subject, it was concluded by the Western Region that a graphic study would best serve its needs initially, and NAFEC's assistance was requested. From this graphic study, it could then proceed on to a dynamic simulation, if necessary.

DISCUSSION

GENERAL.

A graphic ATC study, as differentiated from a dynamic study, has as its basis, all the planning effort that normally precedes a dynamic simulation. It omits only those requirements that are levied by the implementation of the procedural plans in a dynamic facility environment. It includes the development of routes, the definition of control procedures, the assignment of airspace, and the attempted resolution of problem areas. The dynamic simulation is required for the finer adjustments to procedures necessitated by real-time traffic demands

and for the collection of data relative to controller workload, system efficiency, and system capacity, which would be used as measures of comparison between air traffic control systems.

The graphic approach used in this study provided for an analytical comparison of a consensus of a group of raters who compared the various designs developed and also compared the new designs and the present-day Las Vegas terminal operation.

The personnel required to accomplish this task were provided by the Western Region and the USAF. These personnel represented a cross section of operational and supervisory experience in the Las Vegas area, some representation from the Western Region Office, and military air traffic control specialist (ATCS) representation from Nellis AFB. A total of 26 ATCS, both Federal Aviation Administration (FAA) and military, were provided. Among the personnel provided by the Western Region were ATCS's from the Los Angeles Air Route Traffic Control Center (ARTCC) and a terminal instrument procedures (TERPS) specialist from the Western Region Office, each of whom was available as a consultant to all planning teams.

METHOD OF APPROACH.

The graphic study consisted of three phases: (I) the weighting of factors that affected the ATC system and development of ground rules, (II) the development of new procedural plans for the movement of air traffic within the Las Vegas terminal area, and (III) the rating of the plans and analysis of the data from the rating questionnaires.

Though considered a part of phase I, the development of ground rules which established the conditions under which the procedural plans would be developed were coordinated and developed by the NAFEC team, Western Region Office, and Las Vegas facility prior to the actual start of the study. This allowed the planning or development teams to begin their task immediately after the initial briefing with little or no delay.

ASSUMPTIONS/GROUND RULES. The agreed-upon ground rules or conditions were as follows:

1. A common terminal radar control facility (TRACON) will control the Las Vegas terminal area air traffic.

2. Both instrument flight rules (IFR) and visual flight rules (VFR) traffic will be considered in the study.

3. Meteorological conditions throughout the terminal area would be considered comparable at all airport sites.

4. The weather conditions at the airports involved in the study will be considered to be such as to allow VFR flight.

5. Present-day separation standards are to be applied in all cases.

6. Special military flight operations will be considered.

7. New Navigation Aids (NAVAID's) may be established, or existing NAVAID's relocated in order to obtain maximum utilization. Siting will be coordinated closely with the flight standards personnel assigned to the development teams.

8. Noise abatement requirements will be considered in the development and application of operational procedures.

9. Nellis AFB will be considered to have available a GPN-XX airport surveillance radar/precision approach radar (ASR/PAR) or comparable radar system which will be assumed to provide adequate coverage of the Nellis ground control approach (GCA) traffic pattern.

10. Airports to be considered in the study are McCarran International Airport (LAS), Nellis AFB (LSV), North Las Vegas, Boulder City Airport (BLD), and Henderson Sky Harbor Airport.

11. Instrument Landing System (ILS) will be considered at;

   a. McCarran - Runway 25

   b. Nellis AFB - Runways 3R and 21L

12. New IFR operational traffic flows may necessitate reconfiguration of the Las Vegas Terminal Control Area (TCA) airspace. The TCA airspace would not be developed as a part of this study, but the final report would recommend this to be accomplished, if necessary.

13. The present McCarran runway configuration, plus one additional East/West runway located south of and parallel to the present runway (07/25), will be used for planning proposed during a portion of this study.

14. Operational plans will be developed for the runway configurations, i.e., directions of operations in table 1.

15. Operational plans will be developed for the following:

   a. New LAS procedures limited to present airport configuration (figure 1).

   b. New LAS procedures for new airport configuration (figure 2).

   c. Present Nellis AFB procedures versus new procedures for arrivals on runway 21 and departures on runway 3.

TABLE 1. RUNWAY CONFIGURATIONS

AIRPORT AND RUNWAY

Configuration	Type	LAS	LSV	North Las Vegas
1	Departure	25	21	7
	Arrival	25	21	1
2	Departure	19	21	7
	Arrival	19	21	7
3	Departure	1	3	25
	Arrival	1	3	25
4	Departure	25	3	25
	Arrival	25	3	25

PHASE I. A group of five ATCS's was assembled and chaired by a member of the NAFEC project team to perform the task of determining the weighting and ranking of factors that significantly affect an ATC subsystem. These specialists represented a cross section of operational and supervisory experience in the Las Vegas area and included ATCS representation of the USAF from Nellis AFB. The factors are elements of ATC that take into consideration the users, the controllers, and the area. Through individual polling and discussion, the following ranking of importance from most to least and a weight or numerical value representing a portion of 100 was determined:

	FACTOR	WEIGHTS
1.	Interaction	21
2.	Airspace	17
3.	Coordination	14
4.	Routes	12
5.	Controller Workload	10
6.	Radar Vectors	8
7.	Traffic Mix	7
8.	Altitude/Speed Restrictions	5
9.	Noise Abatement	4
10.	Communications Changes	2
		100

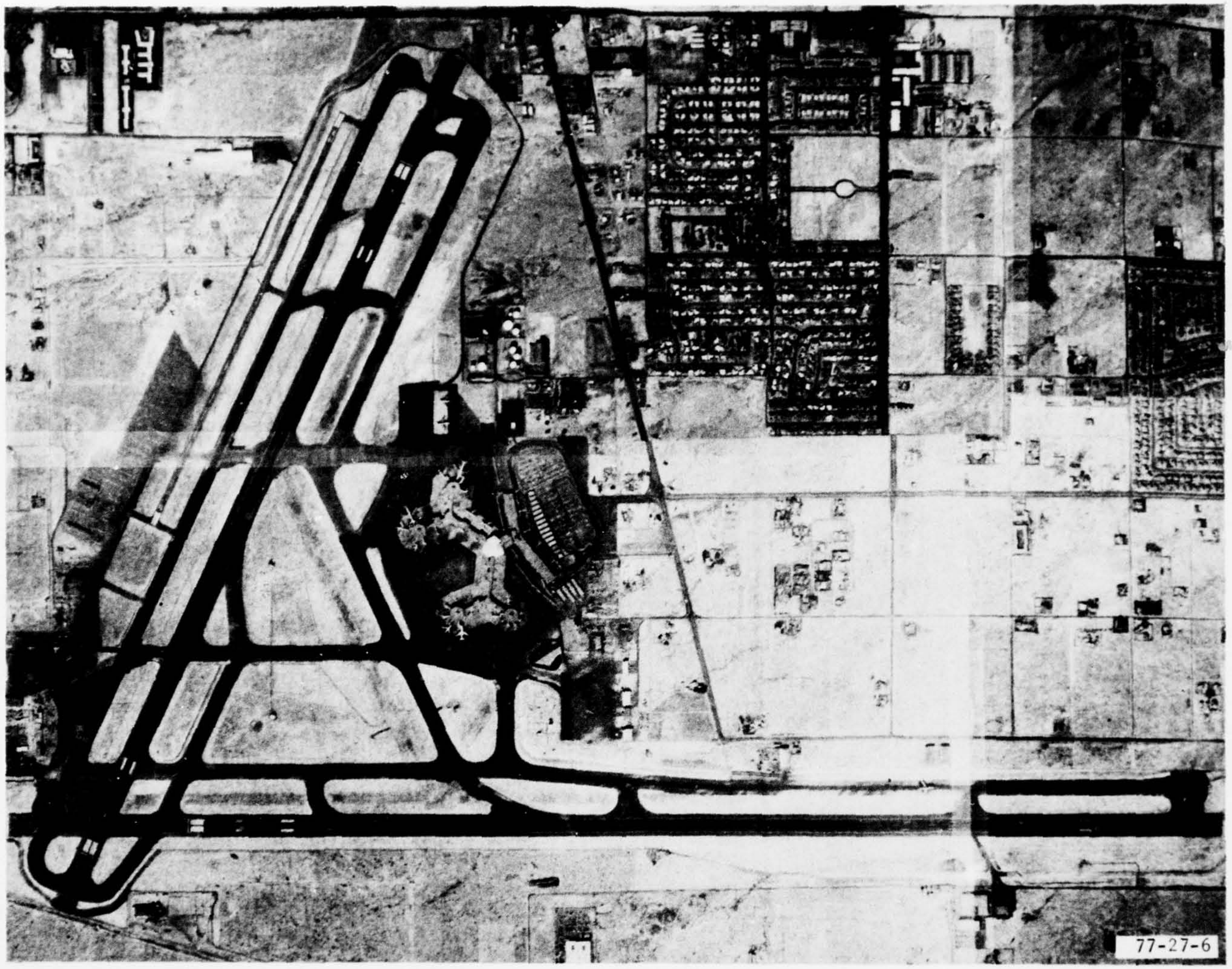

FIGURE 1. AERIAL PHOTOGRAPH OF PRESENT McCARRAN INTERNATIONAL AIRPORT RUNWAY CONFIGURATION

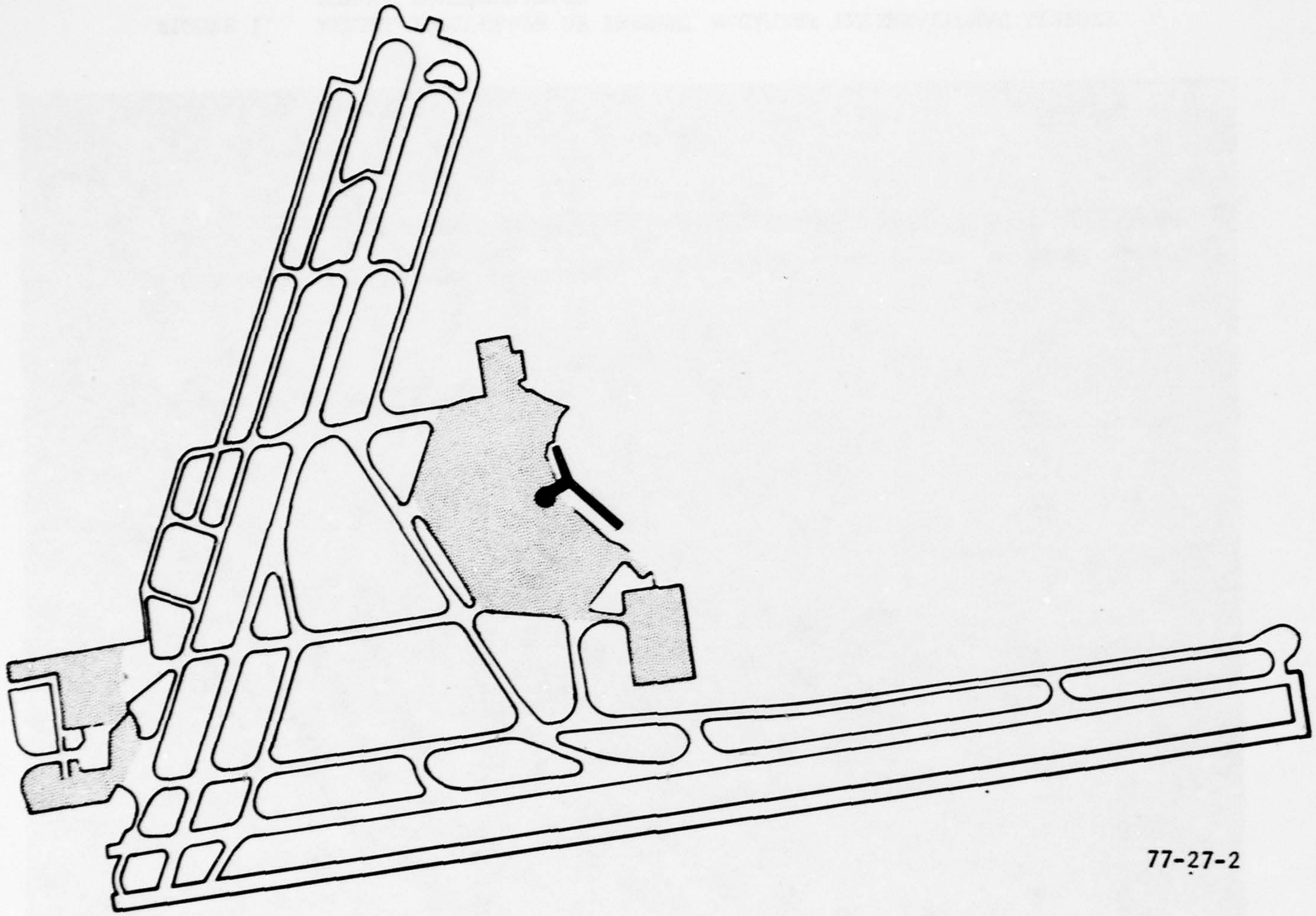

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FIGURE 2. DRAWING OF PROPOSED MCCARRAN INTERNATIONAL AIRPORT RUNWAY CONFIGURATION DEPICTING THE PROPOSED PARALLEL RUNWAY 07/25

Once this group had completed its task, its usefulness to the project ended. No person was used for more than one function during the course of the study. In this manner, bias which could have been introduced by knowledge in other areas of the study was prevented.

PHASE II. Two teams of three ATCS's apiece were assigned to develop procedural plans for the control of air traffic in the Las Vegas terminal area. The teams were assigned specific tasks as specified in the ground rules, specifically ground rule No. 15. Development team 1 was assigned the task specified in 15a, and development team 2 was assigned to accomplish tasks 15b and 15c. Each group worked independently; however, coordination between the two groups was allowed, to ensure comparability in the preparation of the materials and documentation of the plans.

Each team consisted of two ATCS's from the Las Vegas Terminal Facility and one ATCS (military) from Nellis AFB. These teams were augmented on a need basis by specialists from the Western Region Office, knowledgeable in the use of TERPS, and by personnel from the Los Angeles ARTCC. These personnel were available anytime for consultation by phone, or if necessary, were available to proceed to Las Vegas to render assistance or advice. The planning teams were advised that all procedures which impacted upon the ARTCC operation should be coordinated with the designated center personnel.

Each planning team was allotted a period of 2 weeks to accomplish its task. The teams worked consecutively rather than concurrently in order to reduce the impact of personnel scheduling at the facility.

PHASE III. At the expiration of the allotted time for the development of plans, a panel of 14 ATCS raters was formed to evaluate the plans. This group was composed of representation from the Western Region Office, Las Vegas terminal facility, from Nellis AFB, and the Los Angeles ARTCC. None of these personnel were actively engaged previously in the project or had been provided with information relative to the rank or weighting of the factors which had been determined in phase I.

Approximately 6 hours were devoted to briefing the panel on the present-day operation along with detailed information on the plans which had been developed during the study. Following the briefings, an opinion questionnaire (appendix A) was distributed to the raters, and the definition of terms and description of highlights along the 10-point scale were discussed. To ensure complete understanding of each plan, a general review of each plan, by factor, was conducted prior to the rating of each factor. The raters were provided sufficient time to make any pertinent comments to each of the questions.

TEST DESIGN.

Ratings were given to a number of criteria, aspects or factors held to be important by a phase I weighting and factoring group. This group assigned an a priori weight to the criteria. The ratings themselves were collected on a questionnaire which was completed by the phase III evaluation group. A sample copy of the opinion questionnaire developed for this study is located in

appendix A. Nonparametric statistical tests such as rank-order correlation, Friedman two-way analysis of variance, chi-square tests, binomial sign test, etc., were applied to the resultant questionnaire data to determine significance of differences and interrelationships between the weightings and the ratings.

RESULTS

GENERAL.

The results portion of this report is divided into three parts. The first portion, PLAN ANALYSIS, will relate to the specific proposals which the development teams devised for each particular plan, along with an overall review of the comments provided by the phase III rating teams concerning each of the proposals. The second part, PLAN PREFERENCE ANALYSIS, is a discussion of the statistical data. These data were those numerical values recorded for the opinion questionaires and analyzed by use of the binomial sign test using weighted tallies, making multiple comparisons among plans by factors and direction of operation. The third and final part, OPERATIONAL ANALYSIS, is a general discussion of the major proposals of each plan, their relative merits, and an analysis as to the effect the raters opinions may have had on its overall final rating.

PLAN 1 ANALYSIS.

This assigned task for the first development team was to develop new operational ATC procedures for the Las Vegas terminal area limited to the present airport configuration at McCarran International Airport (figure 1). The runway configuration at Nellis AFB can be seen in figure 3.

The proposed ATC procedural plans developed for plan 1 are documented in appendix C. Presented in this appendix are such items as a brief description of the ATC procedures, controller duties, traffic flow diagrams, controller area of jurisdiction or sectorization charts, and airport diagrams. Differences between the present system (appendix B) can be determined by comparing it with the information in appendix C.

Though the development team consistently strived to develop a new and improved traffic flow for the Las Vegas terminal area, it was unable to develop one which provided major changes from the present-day system. Generally, the flow remained the same, with modifications proposed for the standard instrument departures (SID's) and some modification to the ingress and egress procedures to the Nellis Stereo routes.

Primary changes or modifications which this development team had proposed for use and as a portion of its overall plan were as follows:

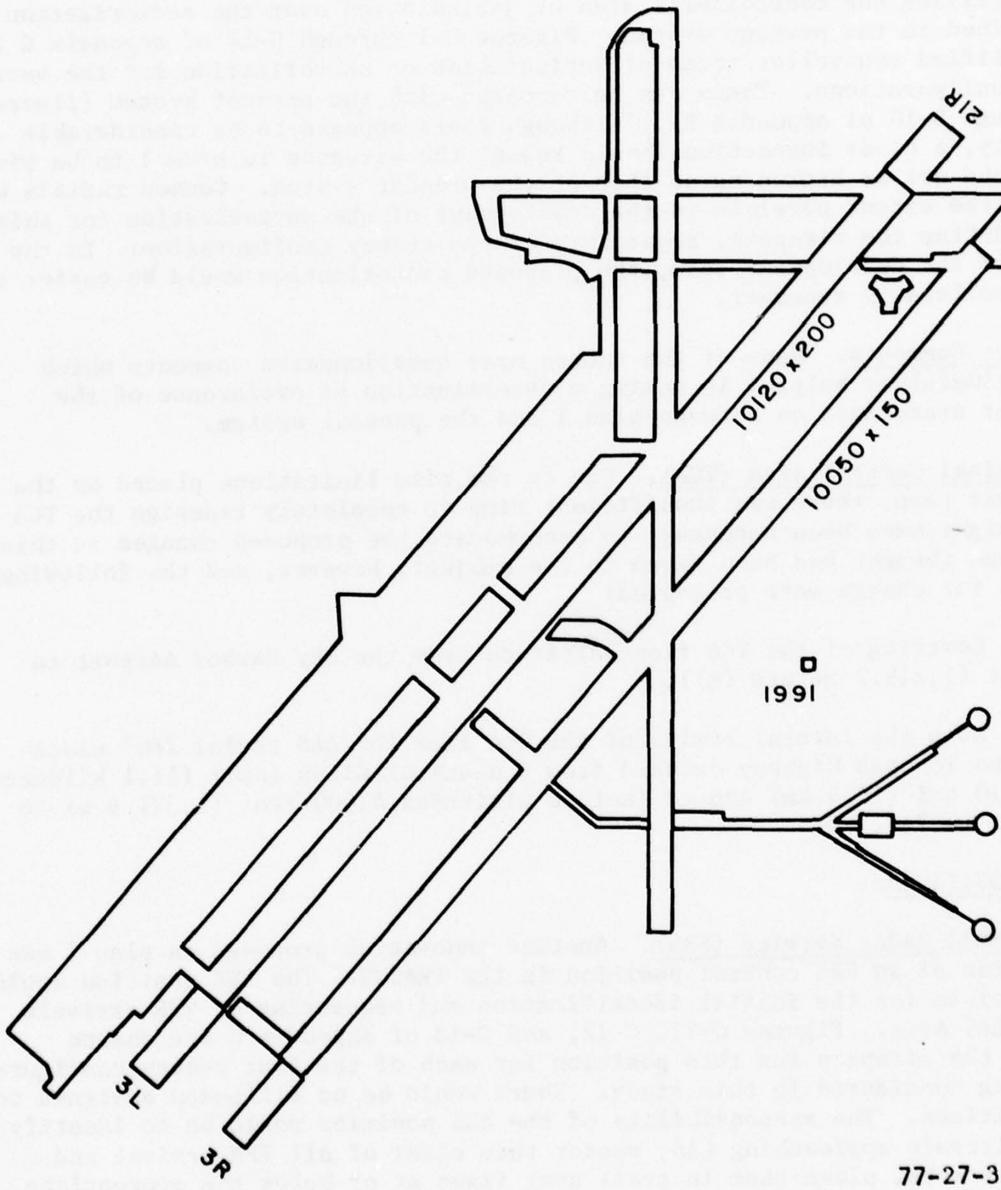

FIGURE 3. ARTIST'S DRAWING OF NELLIS AFB

AIRSPACE.

Controller Sectorization. As stated previously, little or no changes were proposed for the traffic flows; however, the development team did have ideas for simplifying the controller's area of jurisdiction over the sectorization as described in the present system. Figures C-1 through C-14 of appendix C show the simplified controller areas of jurisdiction or sectorization for the various runway configurations. These can be compared with the present system (figures B-1 through B-10 of appendix B). Although there appears to be considerable similarity, a close inspection should reveal the airspace in plan 1 to be simplified and not as broken up as that of the present system. Common radials were used, to the extent possible in the development of the sectorization for this plan to define the airspace, regardless of the runway configuration. In the opinion of the development team, the proposed sectorization would be easier for the controllers to remember.

Rater Comments. None of the raters made questionnaire comments which were meaningful or helpful in making a determination of preference of the controller sectorization between plan 1 and the present system.

Terminal Control Area (TCA). Due to the time limitations placed on the development team, there was insufficient time to completely redesign the TCA area as might have been necessary to accommodate the proposed changes to this plan. Some thought had been given to the subject, however, and the following proposals for change were presented:

a. Lowering of the TCA floor altitude over the Sky Harbor Airport to 4,000 feet (1,219.2 meters (m)),

b. Move the lateral limits of the TCA from the LAS radial 260° clockwise to the Tonopah Highway outward from 6 nautical miles (nmi) (11.1 kilometers (km)) to 10 nmi (18.5 km) and to include altitudes 4,500 feet (1,371.6 m) to 9,000 feet (2,743.2 m).

CONTROL POSITIONS.

Expanded Radar Service (ERS). Another innovation proposed in plan 1 was the addition of an ERS control position in the TRACON. The ERS position would be responsible for the initial identification and sequencing of VFR arrivals into the LAS Area. Figures C-11, C-12, and C-13 of appendix C are charts depicting the airspace for this position for each of the four runway configurations being considered in this study. There would be no altitudes assigned to these positions. The responsibility of the ERS position would be to identify all VFR aircraft approaching LAS, vector them clear of all IFR arrival and departure tracks, place them in trail over fixes at or below the appropriate "low" sector airspace altitudes, and hand them off to the appropriate "low" position (East or West). The ERS position would also be given a handoff on TCA departures that required or requested additional monitoring outside the lateral confines of the low sectors. The ERS position would also hold VFR traffic clear of the low sector's airspace when congestion dictated.

This proposal required the addition of control positions in the TRACON and the assignment of an additional frequency for this position's use. The proposed procedure and use of an ERS position would require an additional frequency change to all VFR aircraft entering the LAS TCA area.

Rater Comments. Of the 14 raters, seven provided written comments on the subject of the ERS position and/or the extra frequency change which would be required by aircraft. Of those seven written comments, six commented highly in favor of it. In essence, the general opinion of these comments was that although plan 1 did require one additional frequency change, it provided for improved service and was worth the extra effort. The other comment was generally against the additional change, stating that in the other plans, frequency changes were only required to assist or go beyond the normal handling. There were three additional comments which were not specific and no determination could be made as to whether they were talking about ERS, feeder final concept, or both. In four comments received, the raters indicated a benefit, with the implementation of the ERS in plan 1, in simplification and easing of the workload on the "Low East" and "Low West" positions.

Final Control Position. The development team proposed that a "final control position" be added in the TRACON. It was planned that this position would be activated only when runway configuration 2 (LAS runway 19R/L) or runway configuration 3 (LAS runway 01R/L) was being used. The operational procedures for this position are described, and the controller sectorization charts are depicted in appendix C. Under the present system, a single "arrival controller" works all IFR arrivals from time of handoff from the LAX ARTCC until the aircraft are sequenced on the final approach and turned over to the tower. Under this proposed concept, there would be a "feeder-final controller" concept. The feeder controller taking the handoff from the ARTCC on all IFR arrival aircraft would provide the initial spacing and sequencing and then would handoff to the final controller as the arrivals approached the final controller's airspace. The feeder controller also would be responsible to see that the arrivals were metered in such a manner as not to overload the final controller.

The establishment of this position required the addition of a control position in the TRACON along with the addition of another frequency for the use of the final controller.

The purpose of the "feeder-final controller" concept was to ease the workload of the arrival position in the TRACON. This proposal, in essence, split the workload in the two configurations where it would be used, and two controllers would control the traffic that one controller handled in the present system.

Rater Comments. Reviewing the 26 questionnaires pertaining to configurations 2 and 3 where the "feeder-final controller" concept is proposed, six raters commented specifically on this subject. The comments received were evenly divided, three for the concept and three against the concept. Two raters indicating a dislike for the concept stated that it would cause an unrealistic number of radar vectors in order to sequence the aircraft properly for the

final controller. The third felt that the final controller would be concerned with two other controllers' traffic; i.e., the ERS and feeder controller's, whereas in the present system, the arrival controller was concerned with only one other controller's flow. The three raters that commented favorably indicated they felt the addition of the final control position would equalize or reduce controller workload and would be beneficial.

TRAFFIC FLOWS (STAR's and SID's).

LAS STAR's. No changes were proposed to existing standard terminal arrival routes (STAR's), nor were there any new STAR's proposed for plan 1.

LAS SID's. In plan 1, it was proposed that all existing LAS SID's be canceled, and a new, common SID be developed to replace those canceled. The new common SID would be a radar SID (appendix C) which would require all departing IFR aircraft to maintain runway heading after takeoff, climb to a specified altitude, and expect radar vectors to the appropriate transition route or exit fix.

Rater Comments. Seven comments were made which reflected upon this proposal. Of the seven, six were against the proposed common SID, and one was for it. The basic feeling against the common SID was that it would require all IFR aircraft to be radar vectored, increasing the overall controller workload unnecessarily. The one comment in favor of the common SID indicated that though the proposal would increase the controller workload by requiring more radar vectoring than the present system, it was felt that a better traffic flow could be established.

LSV Stereo Arrivals. Amendments to the procedures for the Lee and Sally Stereo recoveries are proposed in plan 1. The proposal would hold the Stereo arrivals at altitudes above departures at all critical crossing points.

LSV Stereo Departures. Amendments to the procedures for the Kraig and Apex Stereo departures are proposed. Plan 1 proposed that the Kraig and Apex Stereo departures be tunneled beneath the Lee and Sally recoveries until clear of the arrival routes.

Rater Comments. Three comments were received concerning this proposal on the rating questionnaires. Two of the comments were favorable toward the proposed procedure. The third was written in a cryptic manner, and it could not be determined if the comment was in favor of, or against the proposed procedures. One additional favorable comment was received in the comments which were submitted after the completion of the study.

Navigational Facilities. Plan 1 proposed that a full ILS be established for runway 01R at McCarran International Airport and a back-course approach be developed from that facility for runway 19L.

Rater Comments. No comments were received on this proposal.

PLAN 2 ANALYSIS.

The task of team 2 was to develop new operational ATC procedures for the control of traffic in the Las Vegas terminal area considering an expansion of the McCarran International Airport. The expansion to be considered for the purpose of this study was in the form of a new east/west runway located south of and parallel to the present McCarran runway 07/25. The new runway was to be separated from the present runway 07/25 by a distance of 900 feet (274.3 m) between runway centerlines and by 750 feet (228.6 m) between runway edges. Figure 2 is a drawing depicting the siting of the proposed runway in relation to the present runways.

Following are the proposals which were developed by the team for plan 2, which are changes from the current mode of operation in the Las Vegas terminal area. With each of the proposals presented herein is a breakdown of the rater comments.

AIRSPACE.

Controller Sectorization. The controller sectorization was modified somewhat from that of the present system. Comparisons can be made between the proposed sectorization which is presented in appendix D and that of the present system which is presented in appendix B. The development team designed the sectorization, to the extent possible, establishing boundaries in accordance with the video mapping and a few common radials for all configurations.

Rater Comments. No comments were received or recorded on the opinion questionnaires; however, three of the letters received after the conclusion of the study, which contained additional comments and recommendations, did reflect favorably towards this effort.

Terminal Control Area. Though the ground rules did not require the development teams to actually redesign the TCA's, due to the time limitations placed upon each of the development teams, team 2 was able to accomplish this task also. The revised proposed TCA developed for plan 2 is depicted in figure 4. A comparison with the present TCA can be made by comparing the proposed TCA in figure 4 to that of the present TCA depicted in figure 5.

The proposed TCA coordinated the airspace and TCA boundaries and made the TCA less complex. The following are short descriptions of the proposed changes:

1. Lowered the TCA floor around the Sky Harbor Airport. The higher altitude was no longer deemed necessary by the planners due to the movement of the glider operations from that airport.

2. Lowered the TCA floor in that area northeast of Nellis AFB. This proposal kept aircraft making an instrument approach within the TCA, and allowed for shortening of the GCA pattern by allowing lower altitudes in the pattern.

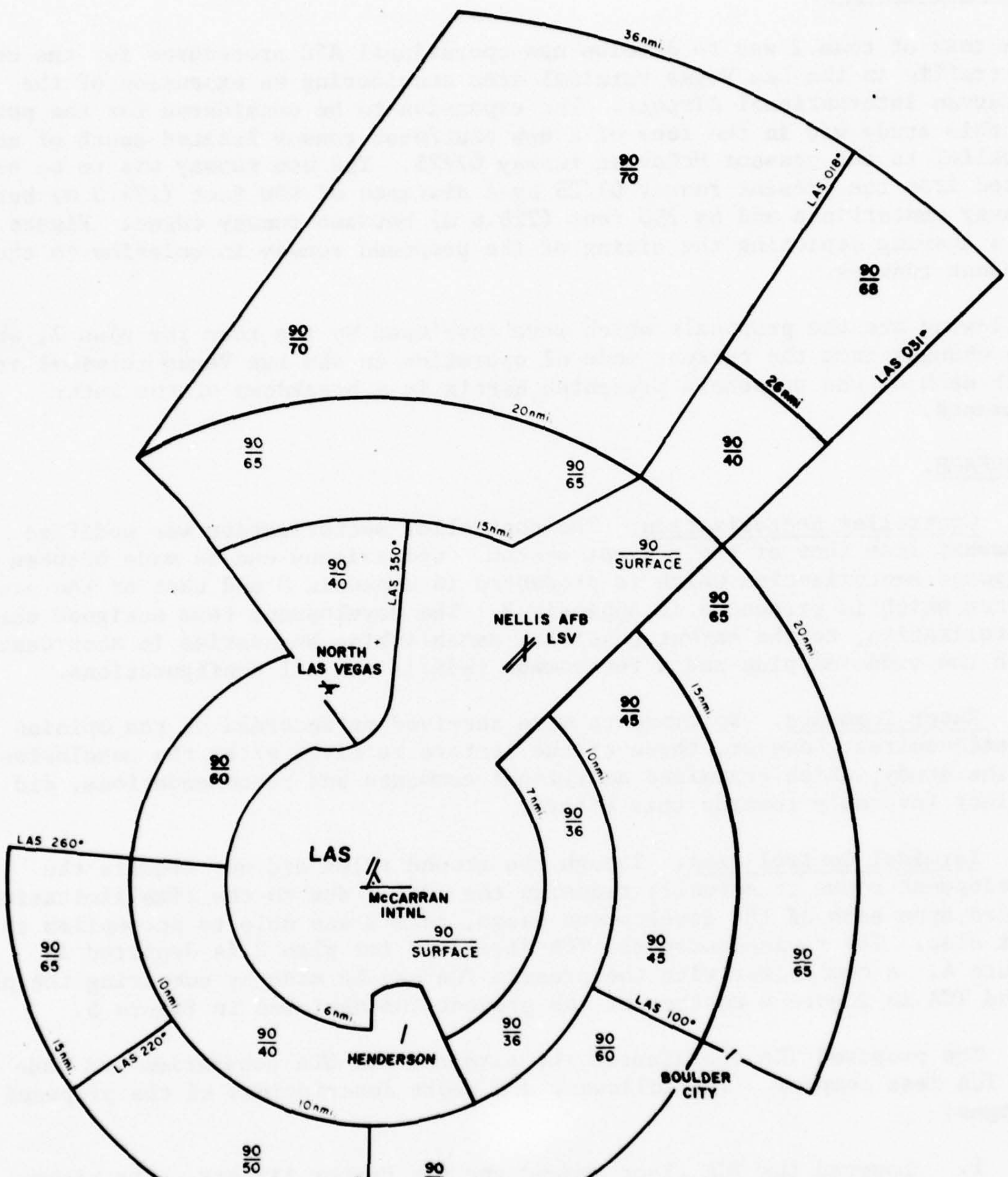

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FIGURE 4. PROPOSED TERMINAL CONTROL AREA (TCA)

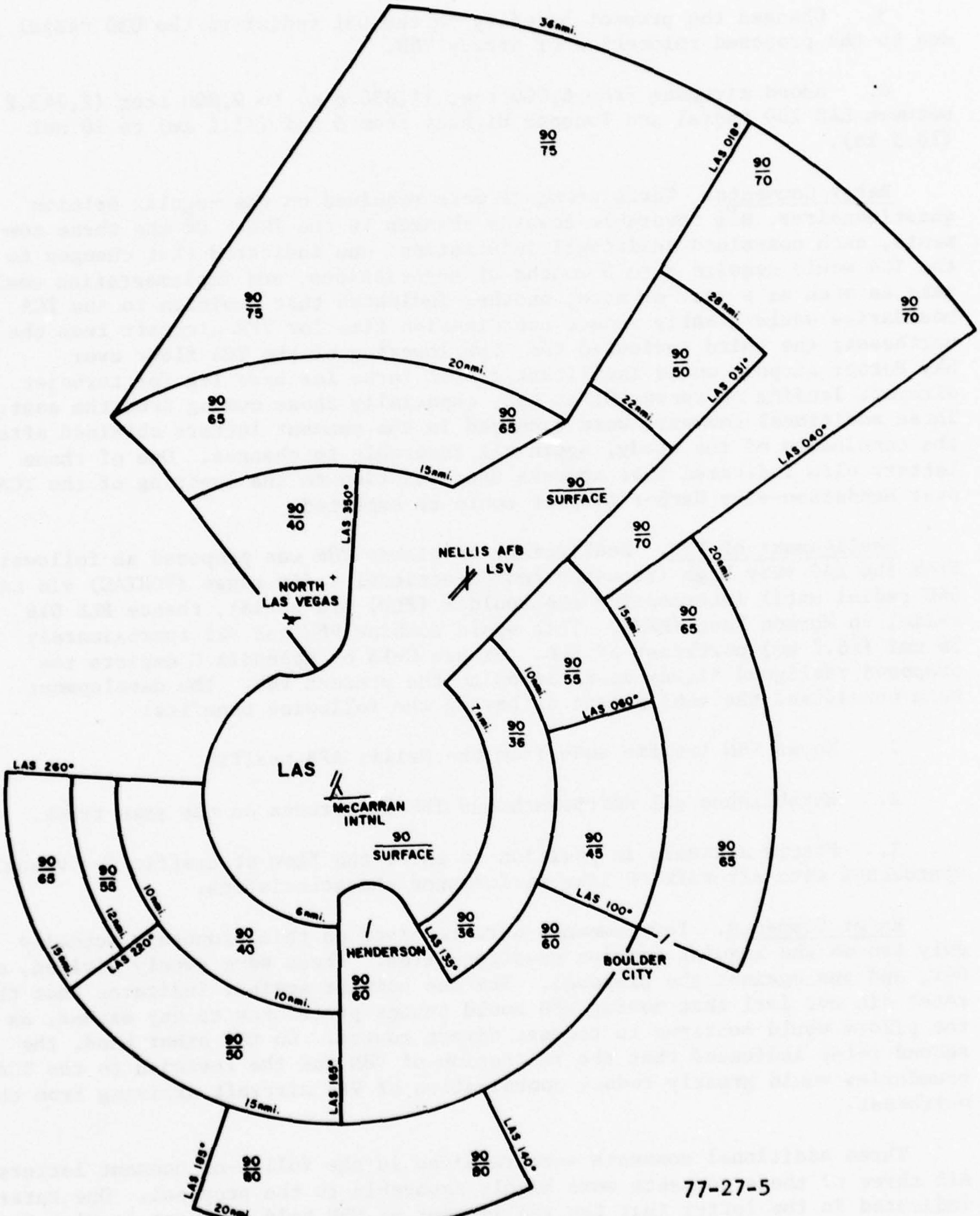

FIGURE 5. PRESENT LAS VEGAS TERMINAL CONTROL AREA (TCA)

3. Changed the present boundary on the 031 radial to the 030 radial due to the proposed relocation of airway V8N.

4. Added airspace from 6,000 feet (1,836.8 m) to 9,000 feet (2,743.2 m) between LAS 280 radial and Tonopah Highway from 6 nmi (11.1 km) to 10 nmi (18.5 km).

Rater Comments. Three comments were received on the regular opinion questionnaires, all favorable towards changes to the TCA. Of the three comments, each contained additional information: one indicated that changes to the TCA would require 3 to 6 months of negotiations, and implementation could take as much as a year or more; another indicated that revision to the TCA boundaries would greatly reduce coordination time for VFR aircraft from the northeast; the third indicated that the lowering of the TCA floor over Sky Harbor Airport would facilitate closer turns for base leg for turbojet aircraft landing on runway 01 at LAS, especially those coming from the east. Three additional comments were received in the comment letters obtained after the conclusion of the study, again all favorable to changes. One of these letters also indicated that adverse user reaction to the lowering of the TCA over Henderson--Sky Harbor Airport could be expected.

Realignment of V8N. Realignment of airway V8N was proposed as follows: From the LAS very high frequency omnidirectional radio range (VORTAC) via LAS 040 radial until intercepting the Boulder (BLD) 016 radial, thence BLD 016 radial to Mormon Mesa (MMM). This would combine V8N and V21 approximately 36 nmi (66.7 km) northeast of BLD. Figure C-13 of appendix C depicts the proposed realigned airway in relation to the present V8N. The development team considered the realignment as having the following benefits:

1. Moves V8N traffic away from the Nellis AFB traffic.

2. Establishes all northeastbound IFR departures on the same track.

3. Places arrivals in position to enter the flow of traffic for visual approaches with aircraft of like performance characteristics.

Rater Comments. Few comments were received on this proposal, actually only two on the regular opinion questionnaires. These were evenly divided, one for, and one against the proposal. The one comment against indicates that the rater did not feel that moving V8N would change procedures to any extent, as the pilots would continue to request direct routes. On the other hand, the second rater indicated that the relocation of V8N and the revision to the TCA boundaries would greatly reduce coordination of VFR aircraft arriving from the northeast.

Three additional comments were received in the follow-on comment letters. All three of these comments were highly favorable to the proposal. One rater indicated in the letter that the realignment of V8N held the most promise for improving the operation. A second rater commented that the realignment of V8N would make it coincide with the Oveto departure. This would accommodate the reduction of unneeded TCA airspace along the existing route and also

isolate the general aviation aircraft more from the higher performance users at Nellis. The letter received from the LAX ARTCC indicated that the realignment of V8N to the east, as proposed, would appear to have little impact on the LAX ARTCC's airway traffic, and therefore had no objections to the relocation, if it would benefit the LAS Approach Control.

Nellis AFB GCA Pattern. Airspace was established in plan 2 for the use of and to be controlled by Nellis GCA. This proposal assumed that ground rule No. 9 had been met; i.e., Nellis GCA having adequate radar coverage. Figures C-15 through C-18 of appendix C have the proposed Nellis GCA traffic pattern depicted.

Rater Comments. Favorable comments were received from those raters who made written comments on this proposal. The general consensus of the raters was that controller workload in the TRACON would be reduced if the Nellis GCA could control aircraft in the GCA pattern and relieve this burden from the LAS TRACON.

NAVIGATIONAL AIDS.

VORTAC for Nellis AFB. Plan 2 recommended replacement of the Nellis TACAN with a VORTAC. The development team felt this change would allow for uniform climb restrictions between the Casino SID and Nellis SID. This proposal would also allow IFR arrivals to be cleared direct to LSV, rather than to LAS, which would reduce coordination between the Los Angeles ARTCC and the Las Vegas terminal and also assist in keeping the LSV aircraft separated from LAS traffic flows. Approaches to runway 03 at Nellis would still utilize the existing approaches derived from the LAS VORTAC. Establishing approach procedures from LSV navigational aids (approach to runway 03R/03L at Nellis) would increase conflicts with LAS arrivals and departures.

Rater Comments. No comments were provided on this subject.

Installation of an ILS on runway 21L at Nellis AFB. Team 2 recommended that an ILS be established for runway 21L at Nellis AFB. The procedures were to be amended so that all IFR approaches to runway 21L would be VORTAC-ILS approaches. If the recommendation to change the Nellis TACAN to a VORTAC and an ILS were to be established for runway 21L, along with a GCA capability, there then would be an instrument approach available to either runway 03R/03L or 21R/21L, regardless of type aircraft or aircraft equipment.

Rater Comments. No comments were provided on this subject.

STAR's, SID's, and VFR Stereo Routes. All STAR's, SID's and Stereo routes for each direction of operation or runway configuration are described in appendix D. All routes which are listed in the appendix and are proposed for this plan have been marked by an asterisk. Those unmarked remain the same as in the present system.

Nellis Runway 21 Stereo Routes. All but the Sally recovery have been amended for plan 2. The proposed procedures revise the altitudes of the arrival and departure routes. Present procedures have the Stereo departures climbing to altitudes above the Stereo recoveries. Plan 2 amends these procedures, whereby the Stereo departures are tunneled below the arrivals. Experience has indicated that during the hot summer months, numerous aircraft could not climb to meet the previous 10,000 foot (3,048.0 m) restriction at Gass intersection. This placed additional hardships on the controllers who had the responsibility of getting the departures through the arrival altitudes. The Lee recovery was changed to conform with pilot requests and to maintain separation of arrivals and departures.

Nellis Runway 03 Stereo Routes. Lee recovery was unchanged from present-day procedure. Sally recovery has been amended with a change in the flightpath, figures C15 and C16 of appendix C. Apex departure was amended as indicated in the procedures presented in appendix D. This procedure still places arrivals below departures as in the present system when operating to runway 03. Placing the arrival above the departure, it was felt, left too rapid a descent for the arrivals. By moving the Sally recovery to the east, the development team was attempting to establish the route and altitudes of this recovery in an area of better radar coverage.

Rater Comments. There were five written comments received on the proposals for the Nellis Stereo routes. Of the five, only one expressed dissatisfaction, indicating that the Lee recovery could have been shortened. No comment was made concerning the altitudes. The other four raters commented favorably towards the proposals in plan 2. Three of the raters indicated that departures should be tunneled below the arrivals, the fourth rater indicated that he felt the Stereo routes were longer in plan 2; however, this was advantageous, as it was safer and required less coordination.

RELOCATION OF VFR PRACTICE AND TRANSITION APPROACHES AT NELLIS AFB. Plan 2 proposed that the USAF eliminate practice VFR and transition local flights at Nellis AFB during daylight hours. This plan proposes that this operation be moved to the Auxiliary Air Field at Indian Springs, which is located approximately 38 nmi (70.4 km) west-northwest of Nellis AFB. At present, this airfield is used primarily as an emergency divert base for aircraft operating in the surrounding training ranges, and by the USAF Thunderbirds Aerial Demonstration Team as a practice area. There is a 7,600-foot by 150-foot (2,636.5 by 45.7 m) usable runway with no NAVAID's. There is an operational control tower, fire station, and almost all facilities to support a normal airfield operation. There has been, within the past 2 years, an operational TACAN which had been established during an exercise. There appears to be room for lengthening of the runway, should this be desirable. Figure 6 is an aerial photograph of the Indian Springs Auxiliary airfield. The following are some items deemed necessary to make Indian Springs sufficient to accomplish the required operations:

1. Installation of a mobile GGA,
2. Staffing of the control tower for expanded operations,
3. Installation of tactical air navigation aid (TACAN),

FIGURE 6. AERIAL PHOTOGRAPH OF INDIAN SPRINGS AUXILIARY AIRFIELD

4. Development of a TACAN penetration for practice approaches, and
5. Development of GCA traffic pattern.

Rater Comments. There were six comments received on the regular opinion questionnaires and five additional comments submitted on the comment letters at the completion of the study. All six comments received on the regular opinion questionnaires were favorable towards the proposal to move the local VFR practice and transition flights from Nellis AFB to Indian Springs. All the comments indicated the raters felt that the workload to the controllers would be reduced significantly and would enhance the operation.

Of the five comments received in the letters, one tended to register doubts--indicating that the procedure would obviously solve some problems, but could create worse. The rater did not expand on this. The other four comments were highly favorable to the proposal.

PLAN 3 ANALYSIS.

The task of plan 3 was to develop operational ATC procedures for the control of air traffic at Nellis AFB which, in essence, would be a head-on type of operation. Landings would be made to the southwest on runway 21, while departures would depart to the northeast on runway 03. Though Nellis AFB has parallel runways, there is insufficient separation between runway centerlines to conduct simultaneous opposite direction operations.

The development team felt that several possibilities existed, the safest of which would be to run arrivals, then departures, but not both at the same time. Any procedure involving an opposite direction would, in their opinion, rely greatly on the effectiveness of scheduling. Scheduling should attempt to create, as much as possible, an environment that would offer little conflict between arrivals and departures.

Following are the proposals or major designs for this plan.

RELOCATION OF VFR PRACTICE AND TRANSITION FLIGHTS FROM NELLIS AFB. In order to minimize delays at Nellis, practice approaches and transition flying need be eliminated at Nellis during daylight hours. It was proposed that these operations be relocated to the Indian Springs Auxiliary Airfield. Information as to Indian Springs and the equipments which would be required to carry out this type operation were discussed in plan 2 and also presented in appendix E. The difference between plan 2 and plan 3 was that this proposal was not considered mandatory in plan 2, whereas in plan 3 it was mandatory for the success of such a system. The proposal to ban these type operations was considered of utmost importance.

Rater Comments. No written comments provided concerning this proposal.

TRAFFIC FLOWS.

1. Kraig Stereo Arrival Runway 21L - See procedures in appendix E for detailed procedures.

2. Apex Departure Runway 03 - See procedures in appendix E for detailed procedures.

3. IFR Departures - Depart on published SID's for runway 03. See appendix E for detailed procedures.

4. IFR Arrivals - Appendix E again provides detailed procedures.

Few aircraft utilize these procedures. Those that do generally are transient aircraft. Coordination is required between the LAS TRACON and Nellis Tower which must be notified to eliminate confliction. Whenever there is an IFR approach, all Nellis departures automatically go to a call-for-release status until Nellis Tower has landing assured.

Rater Comments. Six comments were received on the regular opinion questionnaires. These all related basically to the Stereo arrival procedure. The general feeling of the raters was that the procedure was too complex and would increase the Nellis Tower workload considerably. There was also the feeling that there was too little room for error and that the least deviation from the procedures would cause a safety violation.

PLAN PREFERENCE ANALYSIS.

GENERAL. Table 2 presents a summary of the statistical analysis in a factor-by-direction matrix of the present system, plan 1, and plan 2. Numerical results are presented in table 3.

In table 2, the operational factors are presented along the left edge of the table, the directions of operation are represented by the columns. The data in the column on the extreme right represent the results for each of the factors totaled across directions of utilization. The bottom row contains the results for each of the directions of operation totaled over factors. The entry in the lower right-hand corner represents the results of the entire study (compared over factors and directions of operations). As indicated previously, numerical results are not shown in table 2; the means for each of the plans or systems having been converted to a letter. The letter representation is as follows: A = present system, B = plan 1, and C = plan 2. Within the table itself, the means which are covered by the same line do not differ significantly. Means not covered by the line differ significantly. The blank cells indicate the absence of any significant differences. The plan means are arranged best, left, to worst, right.

ANALYSIS. The results by factors, table 2 extreme right-hand column, show a significant preference for plan 2 (C) over plan 1 (B), or the present system (A). Plan 1 and the present system are relatively evenly divided, with plan 1 being favored over the present system in two factors, airspace and controller workload, while the present system was favored over plan 1 in three factors, coordination, traffic mix, and communications changes. It must be pointed out that plan 1 was preferred over the present system in two factors which had high weights assigned. The present system on the other hand, was preferred over plan 1 in only one factor of high rank, and two other factors of lower rank.

TABLE 2. RESULTS FOR LAS VEGAS TERMINAL AREA GRAPHIC STUDY--MULTIPLE COMPARISONS AMONG PLANS BY FACTOR AND DIRECTION OF OPERATION

Factors	Direction 1 LAS 25/19 LSV 21	Direction 2 LAS 19 LSV 21	Direction 3 LAS 01 LSV 03	Direction 4 LAS 25/19 LSV 03	Weighted Totals Across Dorectopms
Interaction	C B A	C A B	C B A	C A B	C B A
Airspace	B C A		B C A	C B A	B C A
Coordination		C A B	C A B		C A B
Routings					
Controller Workload	C B A	B C A	C B A	B C A	B C A
Radar Vectoring	C A B	C B A			C A B
Traffic Mix		A C B	C A B		A C B
Altitude/Speed Restrictions	C B A		C A B		C A B
Noise Abatement					
Communications Changes	A C B	A C B	A C B	C A B	A C B
Weighted Totals Across Factors	C B A	C A B	C B A	C A B	C B A Entire Study

A = Present System
B = Plan 1
C = Plan 2

Note: Means covered by the same line do not differ significantly.
Means not covered by the same line differ significantly.
Blank cells indicate the absence of significant differences.
Plan Means are arranged --Best = Left, to Worst = Right.

TABLE 3. ANALYTICAL RESULTS FOR THE LAS VEGAS STUDY—MULTIPLE COMPARISONS AMONG PLANS BY FACTORS AND DIRECTION OF OPERATION (NUMERICAL VALUES)

Factors	Direction 1 LAS 25/19 LSV 21	Direction 2 LAS 19 LSV 21	Direction 3 LAS 01 LSV 03	Direction 4 LAS 25/19 LSV 03
Interaction	C B A 5.7 5.4 5.2	C A B 5.2 5.1 4.8	C B A 5.6 5.0 4.8	C A B 6.8 5.5 5.5
Airspace	B C A 7.1 6.9 6.0		B C A 7.3 7.2 6.8	C B A 7.3 6.6 6.6
Coordination		C B A 6.0 5.6 5.4	C A B 6.4 5.7 5.4	
Routing				
Controller Workload	C B A 8.0 7.7 6.9	B C A 7.7 7.3 6.6	C B A 6.6 6.4 5.7	B C A 7.3 7.2 6.8
Radar Vectoring	C A B 6.0 5.2 5.0	C B A 6.3 5.3 4.6		
Traffic Mix		A C B 6.3 6.1 4.6	C A B 6.5 6.3 5.1	
Altitude/Speed Restrictions	C B A 7.5 6.8 6.7		C A B 5.9 5.6 5.6	
Noise Abatement				
Communications Changes	A C B 8.9 8.7 6.7	A C B 8.9 8.9 6.5	A C B 8.8 8.8 6.4	C A B 8.7 8.7 7.7

A = Present System
B = Plan 1
C = Plan 2

Note: Means covered by the same line do not differ significantly.
Means not covered by the same line differ significantly.
Blank cells indicate the absence of significant differences.
Plan Means are arranged—Best = Left, to Worst = Right.

Plan 2 was preferred over both plan 1 and the present system in 4 of the 10 factors. Two of the four were the first- and third-ranked factors with high weights. Plan 2 was also found statistically equal to plan 1, in the second ranked factor (airspace), both being statistically preferred over the present system. Statistical analysis of the ratings for plan 2 further shows that under the factor "controller workload," plan 2 was statistically equal to plan 1 and preferred over the present system. For the factor "traffic mix," plan 2 was found statistically equal to the present system, but significantly preferred over plan 1. Of the two factors just mentioned, controller workload was the higher ranked of the two and had a higher weight attached.

In analysing the data by direction of operations (table 2, bottom row), plan 2 was found to be statistically preferred over plan 1 and the present system in all four directions of operations.

In configuration 1, plan 2 was rated highest, with plan 1 rated second, being preferred over the present system. In configuration 2, plan 2 again was rated highest; however, in this direction of operation, the present system was rated second over plan 1. In configurations 3 and 4, plan 2 again was rated highest by the raters; however, in these configurations, no statistically significant differences were found to exist between the present system and plan 1; therefore, they are rated equal.

Considering the overall results, all directions of operations and all factors, when the factor and direction weightings were used, the analysis indicated the raters significantly preferred plan 2 over either plan 1 or the present system. The analysis also indicates that plan 1 was significantly preferred by the raters over the present system.

PLAN PREFERENCE ANALYSIS OF PLAN 3.

General. The statistical analysis of plan 3 is presented in table 4. This table presents the summary of the results of the study by multiple comparison between plan by factor and direction of operation.

In table 4, the two columns to the right of the table represent the two configurations or directions of operation. The column furthest to the right represents the proposed "head-on" operation of plan 3. The inner column, or that immediately following the factors, represents the present system of operation at Nellis AFB. In the analysis of the ratings, wherever a significant difference was found to exist in one system over another, an "X" was placed in that column behind the preferred system factor, according to the rater's evaluations. The blank cells indicate the absence of any significant differences. Numerical values for this analysis can be seen in table 5.

Analysis. From the analysis of the data, it is evident that the raters preferred the present Nellis system over plan 3. The present system was preferred in 6 out of the 10 factors. No statistical differences were found to exist in the remaining four cells. It is pointed out that the present system was favored in the five higher ranked factors.

TABLE 4. RESULTS FOR NELLIS AFB "HEAD-ON" GRAPHIC STUDY--MULTIPLE COMPARISON AMONG PLANS BY FACTOR AND DIRECTION OF OPERATION

Factors	Present System Arrs. Rwy 21 Dpts. Rwy 21	Proposed System Arrs. Rwy 21 Dpts. Rwy 03
Interaction	X	
Airspace	X	
Coordination	X	
Routings	X	
Controller Workload	X	
Radar Vectoring		
Traffic Mix		
Altitude/Speed Restrictions	X	
Noise Abatement		
Communications Changes		

Note: X = Means differ significantly. The X is placed under the system preferred by the raters.

Blank cells indicate the absence of significant differences.

TABLE 5. RESULTS FOR NELLIS AFB "HEAD-ON" STUDY--MULTIPLE COMPARISON AMONG PLANS BY FACTOR AND DIRECTION OF OPERATION (NUMERICAL PRESENTATION)

Factors	Present System Arrs. Rwy 21 Dpts. Rwy 21	Head-On Arrs. Rwy 21 Dpts. Rwy 03
Interaction	*7.1	4.9
Airspace	*7.2	5.7
Coordination	*7.3	4.9
Routing	*7.6	5.4
Controller Workload	*7.2	3.3
Radar Vectoring	8.0	7.9
Traffic Mix	8.1	7.8
Altitude/Speed Restrictions	*7.3	5.7
Noise Abatement	7.0	8.0
Communications Changes	8.7	8.7

Note: * = Means differ significantly, the asterisk placed next to the numerical means indicates the preferred system. No asterisks indicate the absence of significant differences.

OPERATIONAL ANALYSIS.

GENERAL. As indicated in the statistical analysis, plan 2 was rated highest by the raters over plan 1 or the present system. This preference was consistent for each of the four configurations as well as for the results for the overall study. This section will discuss each of the two plans and detail some of the major proposals from each, delving into the possible reasoning that the raters used for their ratings based on their comments from the questionnaires and from observations during the rating process.

PLAN 2. Plan 2 was rated highest over plan 1 and present system and was significantly preferred in all directions of operations and for the entire study. This was due to the acceptance of many of the proposals which the development team devised for this plan.

From the comments taken from the opinion questionnaires and from the general conversation during the rating process, it was obvious the raters were influenced heavily by the added capability of McCarran International Airport which was provided by the addition of another runway. This runway, for the purpose of this study, was located south of and parallel to the present McCarran runway 07/25, with the runways separated by 900 feet (274.22 m) between runway centerlines.

Though the raters were influenced by the additional proposed runway, and the addition of such a runway would provide an increased capability, there was a unanimous agreement among the raters that the 900-foot (274.22 m) separation between runway centerlines was not desirable. The proposed runway would provide advantages over the existing airport configuration, during VFR conditions. It did not, however, provide for the full potential of the airport which could be achieved with additional separation. The most optimum potential could be achieved with separation which would allow simultaneous operations, especially during IFR conditions.

The second most discussed proposal contained in this plan was the restriction of VFR practice and transition flying at Nellis ABF during the daylight hours and the transfer of this activity to the auxiliary airport at Indian Springs located approximately 38 nmi (70.30 km) northwest of Nellis AFB. This proposal would tend to reduce controller workload considerably for the personnel in the Las Vegas TRACON as well as the Nellis Control Tower. This would also have an effect on the operations at Nellis AFB itself by reducing the traffic pattern congestion. This, then, would have the effect of reducing or eliminating, to a great extent, delays to the mission aircraft which were returning from the various ranges or are preparing to depart. A cost benefit study might indicate a benefit, all around, in that the number of practice approaches (GCA, touch-and-goes, penetrations, etc.) might also be increased, because the activity would be conducted at a less densely populated airport.

The Air Force would, of course, have the requirement of expanding or adding to its facilities at Indian Springs. Some of the items which would be required would be: (1) a mobile GCA unit, along with operation and maintenance personnel,

(2) installation of a TACAN and development of a practice VFR penetration, (3) possible increase in the present control tower personnel complement to handle the increased flight activity, and (4) possible increase in other ground support personnel such as fire crews, flight line, and aircraft maintenance personnel etc.

It is noted that the ATC staff review report dated January 23, 1976, which recommended that a simulation study be conducted at NAFEC, also recommended that an AN/MPN-13 radar and an AN/MRN 7 and 8 ILS be installed at Indian Springs. It would appear from this that there was some thinking on the part of Air Force personnel about providing some capability at Indian Springs; however, there was no indication as to what extent.

The one major item which must be investigated by the FAA and USAF is the possible impact that this activity might have upon general aviation. It is understood that a considerable number of general aviation aircraft use this area, following the highway through the pass to and from the Las Vegas area. Therefore, a heavy concentration of jet activity at Indian Springs could have an effect upon this general aviation population, and it appears that steps must be taken to determine if this activity could be conducted safely in this particular area.

Plan 2 also had additional proposals which concerned Nellis AFB. These proposals were (1) placement of an ILS on runway 21L, (2) allocation of airspace for a GCA pattern for Nellis AFB, which would be controlled by Nellis GCA, (3) amendments to the Stereo recovery and departure procedures, (4) replacement of the Nellis TACAN with a VORTAC, and (5) amendment of the Nellis Casino SID.

With regard to items 1 and 2 above, the ILS being placed on runway 21L would be beneficial, since that is the predominant operation at Nellis. This would facilitate practice approaches to Nellis, especially until the time practice approaches are moved to Indian Springs, if they ever are. It would also be beneficial during times of light traffic (i.e., when missions are not being flown at Nellis or after daylight hours), and practice approaches could be resumed at Nellis. This, then, would blend the ILS approach with the general flow of traffic, would not require the aircraft to overfly the city of Las Vegas as they currently do on an ILS to runway 03, and would keep the aircraft separated from McCarran traffic flows.

As far as the GCA traffic pattern being controlled by Nellis GCA is concerned, this would reduce the workload for the Las Vegas TRACON. This procedure is not possible at present, as the Nellis GCA radar is not usable, except for the conduct of the PAR or precision portion of the final approach. The proposal made for plan 2 in this study assumes, according to the ground rules, that a usable radar system is available at Nellis, as suggested by the ATC staff review report, which indicates a new generation GPN-XX ASR/PAR system is scheduled for Nellis in FY 78.

In the same ATC staff review dated January 27, 1976, it has been recommended that (1) immediate programming action be initiated to relocate the ILS system now located on 03R at Nellis AFB, to runway 21L (57 FWW/DC) and (2) the fixed radar program for Nellis, GPN-XX ASR and PAT (H) be expedited (TAC/DCX). These recommendations, if followed, would benefit both Nellis and the Las Vegas terminal greatly.

The proposal for the reversal of altitudes for the Stereo recovery and departures in this plan for the runway 21 operation were well received by the rating team. All comments received indicated that the raters preferred that the departures be tunneled under the arrivals until clear of the arrival routes prior to climbing to the higher altitudes. This would be especially beneficial during the hot summer months, when it has been indicated that certain aircraft have trouble making the altitude restrictions on the Stereo departure routes. The proposed procedure would definitely reduce workload and tension in the TRACON.

There were fewer comments concerning the amendments for the changes to the Stereo routes to the runway 03 operation. This made it difficult to determine if the raters preferred the new procedure or not. The one or two comments received were unfavorable, because of the length of the proposed recovery route which was made slightly longer in plan 2. There was also a question whether or not the procedure to change expected altitudes of arrivals and departures when the runway was changed from runway 21 to 03 was acceptable. It was suggested that it would be better to keep the expected altitudes at the Exit and Entry fixes constant, regardless of runway in use.

The proposal for changing the Nellis TACAN to a VORTAC was looked upon favorably by the raters. This, in the development team's words, "provides an approach to Nellis AFB for any aircraft in the AF inventory regardless of navigational equipment." It would also enable the LAX ARTCC to clear aircraft direct to Nellis AFB, rather than to the Las Vegas or Bolder VORTAC's, keeping these aircraft separated from McCarron traffic. With the revised Casino Departure SID, which would be based on the Nellis VORTAC, rather than the Las Vegas VORTAC, Nellis departures would cross Las Vegas southbound at higher altitudes --thus presenting fewer problems with the McCarron traffic flows.

Realignment of V8N was also favorable to the raters. This was coordinated by the development team with the designated contact in the Los Angeles ARTCC during the study. The ARTCC personnel offered no objections to the proposal. This change afforded more separation between aircraft on the airway between the Las Vegas VORTAC and the Morman Mesa VORTAC and Nellis AFB aircraft. The prime question was: Will the VFR aircraft that might fly V8N now follow the new V8N, or will they persist and continue flying direct and not take advantage of the added protection that the realignment would provide?

There were five comments received concerning the proposed changes to the TCA; two on the regular rating questionnaires, and three in the post-study letters. The comments were written in such a manner that they cannot be used to determine a preference between plan 1 or plan 2 proposals; however, the comments, in general, were favorable to some changes to the present TCA.

Information presented during the presentations of the plans indicated three problem areas. The first was in the western quadrant of the TCA. It was stated that some departures were unable to remain within the confines of the present TCA, others had difficulty doing so. Both proposals, plans 1 and 2, proposed additional airspace to be added in this area to alleviate the problem. The second problem area was in the southern quadrant, in the vicinity of the Henderson Airport. The problem as stated was that the present TCA floor made it difficult for McCarran arrivals to descend to traffic pattern altitude when runway 01 was in use. Again, both plans 1 and 2 proposed a lower TCA floor in this area. One of the reasons the floor of the TCA was established at its present level in the Henderson area, it was indicated, was to accommodate glider operations. (The gliders have, it is understood, since moved from Henderson and are now located at another airport.) The third area was that area to the northeast of Nellis AFB. It was stated that the present TCA boundaries and floors do not protect an aircraft making an instrument approach to Nellis. Plan 2 proposed a change which would modify the TCA area, extending northeast along the extended centerline of the Nellis runway, by lowering the floor and amending the boundaries. By so doing, the developers stated, an instrument approach could complete the entire approach and remain within the confines of the TCA.

Each of the proposals to alleviate the problem areas, both plans 1 and 2, required the acquisition of additional airspace for the TCA. This understandably is a difficult task, especially in an area such as Las Vegas where usable airspace is at a premium due to terrain.

As to the suggestions on revisions to the controller sectorizations, few comments were received, and those that were, did not reflect a preference between the sectorization plans of plan 1 or 2. The comments did indicate that both development teams succeeded in simplifying the sectorization over the present sectorization.

Comparison between the present-day sectorization and that developed for plan 2 can be made by comparing the charts in appendix B (figures B-1 through B-10), with those in appendix D (figures D-1 through D-7). A visual comparison indicates that the plan 2 sectorization is less complicated, for the most part, than the present-day sectorization.

PLAN 1. Plan 1, overall, was rated second to plan 2, but preferred by the raters over the present system (table 2). In runway configuration 1, plan 1, as in the overall study rating, was rated second to plan 2, with both being preferred over the present system. In configuration 2, the present system was rated second, being preferred over plan 1. In both configurations 3 and 4, there was no significant difference between plan 1 and the present system.

A thorough investigation of the opinion questionnaires was made in order to determine what prompted the raters to switch opinions concerning plan 1 between runway configurations 1 and 2. One must remember that in plan 1, the development team made no changes to traffic flows in their planning; consequently, throughout this plan, for all four runway configurations, the traffic flow was the same as the present system. The one change proposed was when

operating under configuration 2 or 3, a feeder-final controller concept was proposed. In the present system, and in plan 1 configurations 1 and 4, the arrival controller worked arrival aircraft from handoff from the ARTCC until they were sequenced and established on the final, approached and changed to the tower frequency. In plan 1, configurations 2 and 3, a feeder controller received the handoff from the ARTCC, established the initial sequence to the IFR aircraft, and then handed off to a final controller prior to the aircraft entering the final controller's airspace. From the review of the opinion questionnaires and from the comments heard during the rating process, it has been determined that the majority of the raters did not prefer the feeder-final concept and consequently rated this plan lower because of it.

It should be noted that from the analysis of the 27 opinion questionnaires which were distributed for the two runway configurations which utilized the feeder/final concept, only six comments were actually logged specifically addressed to this proposal. Of these six comments, three were favorable, indicating that the raters felt the feeder-final concept would reduce individual controller workload or more equally distribute this workload. The other three were against the concept, citing adverse traffic mix for the final controller or inadequate airspace for that position. The remainder of the raters did not comment; however, no other plausable explanation could be found to explain the generally low rating plan 1 received, especially in runway configuration 2, other than an obvious bias towards the feeder-final concept. There were other comments, both pro and con, in the questionnaires; however, they were written in such a general manner that they did not specifically point to the feeder-final concept or the expanded radar service (ERS) position and couldn't be counted as either.

On the proposal for the establishment of ERS position, there were 54 questionnaires distributed. The analysis of the comments indicated that 44.4 percent of the questionnaires were returned with comments; of these, 75 percent responded favorably and 25 percent were against. Generally, the raters who were against the proposal for the ERS position cited extra coordination for the low controllers and additional frequency changes for the pilots. The raters who responded favorably to the proposal felt that the ERS position would tend to reduce and or equalize controller workload, and though there would be an extra frequency change required, it would be beneficial, in that better service could be provided.

Very few comments were received concerning the proposed revision to the Las Vegas SID's whereby all present SID's would be deleted and one common SID (radar SID) developed. Those comments that were received were not favorable to the proposal, citing that it would cause an additional workload by requiring more radar vectoring and by increasing the controller workload over the present system.

As to the amendment to the Nellis Stereo arrival and departure procedures, whereby the departures tunneled below the arrivals until clear of the arrival routes, the raters responded favorably. Four raters responded on the regular

rating questionnaires concerning the amendments to the Nellis Stereo arrival and departure procedure. In essence, plan 1 reverses the present procedure, whereby departures are climbed through the altitude of arrivals, by tunneling the departures below the arrivals until clear of the arrival routes, then climbing the departures to higher altitudes. It was indicated, during the briefings, that difficulties were encountered, especially during the hot summer months, with some aircraft being unable to make the present altitude restrictions required by the Stereo procedures. With the proposed change, this difficulty would be minimized. The raters, in their comments, indicated they felt that the proposed tunnel procedure would make the LSV flow more even, and be more realistic, easier to control, easier for pilots to attain the altitude restrictions, and more beneficial to the TRACON by reducing controller workload. As in some of the previous comments, the raters wrote their comments in a very general manner. Again, they did not specify a preference between the procedures as proposed in plan 1 or plan 2, only indicating that they did agree that the tunnel procedure was better than the present operation for the Stereo routes.

Raters had few comments concerning proposed TCA changes. They primarily registered skepticism over whether the changes could be made and the length of time which would be required to negotiate any proposed changes to the area. It appears a careful study should be made of the various proposals for changes to the TCA areas to determine those most advantageous to the terminal area.

One comment was made on the opinion questionnaire on the proposed simplification, or redesign to controller sectorization. There were two favorable comments received on the follow-up letters received from the raters. From the analysis of the drawings of the present controller sector charts (appendix B, figures B-1 through B-10) and comparing them with the proposed sectorization (appendix C, figures C-1 through C-14), it is apparent that the development team had succeeded in developing simplified sectorization.

PLAN 3. As noted in the statistical section of this report, the present Nellis AFB operation of runway utilization was preferred by the raters, overwhelmingly. The procedure whereby all arrivals land on runway 21L and departures takeoff to the northeast on runway 03L would, of course, benefit noise abatement and would keep arrivals from overflying the city of Las Vegas; however, at the cost of an extremely complex operation.

The requirement that all local VFR practice approaches and transition flights be eliminated at Nellis AFB for this type operation is a sound one.

Even with the elimination of the practice and transition flights from the traffic pattern at Nellis, the procedures required by this type operation would increase the workload of the control tower personnel at Nellis tremendously. The biggest problem the Nellis tower personnel would face would be making the determination when a departure could safely be released with respect to an arrival aircraft in the traffic pattern.

There is also the problem of instrument approaches. Whenever an instrument approach is being made, all Nellis departures must then be coordinated for release with the Las Vegas TRACON. Release of the departure would be predicated upon the position of the arrival aircraft at the time the request for release of the departure is received by the TRACON controller.

From the comments received from the raters concerning this plan, the prime concern was safety. With the increase in the workload at the tower and such critical determinations required as to when departures might be cleared for takeoff in relation to arrivals made safety aspects of this operation questionable. It was obvious that they felt delays at Nellis would increase, operations would be drastically reduced, and Nellis AFB control tower workload drastically increased.

The reduction to the operations rate and the anticipated delays which would be caused by this type of operation would have an extremely detrimental effect upon the mission requirements of Nellis.

CONCLUSIONS

Based on the results of this graphic study, it is concluded that:

1. Plans 1 and 2 are preferred by the raters over the present system, with plan 2 also being preferred over plan 1.

2. The establishment of an "ERS" (Expanded Radar Service) position in the Las Vegas TRACON is considered desirable by the raters.

3. The raters approve the proposals, in both plans 1 and 2, whereby Nellis Stereo departures tunnel beneath the Stereo recoveries.

4. The realignment of V8N between the LAS VORTAC and MMM VORTAC is regarded favorably.

5. The relocation of practice and transition flights from Nellis AFB to the Indian Springs Auxiliary Airfield is considered desirable by the raters.

6. Plan 3 is not considered favorably for adoption because of:

   a. Questionable safety
   b. Controller workload
   c. Degradation of Nellis missions due to delays.

RECOMMENDATIONS

It is recommended that:

1. The most desirable proposals, as determined by the Western Region and LAS Facility personnel, from plan 1 and 2 be incorporated into the present operation of the Las Vegas terminal facility.

2. Plan 3 should not be considered for adoption, due to questionable safety, complexity of operation, expected increase in controller workload, and adverse effects to missions at Nellis due to anticipated delays.

3. A feasibility study be conducted by the Western Region and USAF on the proposals for the use of Indian Springs Auxiliary Airport for relocation of VFR practice and transition-type flights from Nellis AFB.

APPENDIX A

RATER OPINION QUESTIONNAIRE

RATING FORM FOR ASPECTS OF LAS VEGAS TERMINAL AREA ATC

NAFEC PROJECT NO. 218-150-810

NAME OF RATER: ______________________ **DIRECTION OF OPERATION:** ________

FACILITY OR OFFICE: ________________ **DATE:** ________

TELEPHONE: ______________________

This form will be used to record your evaluation of the three plans (A, B, and C) under one direction of operation. Please use the following letter identification when rating the plans:

- A = present procedures and present airport configuration,
- B = new procedures and present airport configuration, and
- C = new procedures and new airport configuration.

In rating each aspect, choose a point on the scale that most accurately reflects your opinion of the plan under consideration. Place the left edge of the letter identifier at the chosen point. Highlights under each scale (at 1, 4, 7, and 10) are provided to assist you in determining the exact value. Your comments will help in the final evaluation. Please record them in the space provided.

1. ROUTINGS - A circuitous routing is a path that takes an aircraft in directions radically opposed to the shortest possible path.

1	2	3	4	5	6	7	8	9	10
All routes circuitous requiring expert pilotage and/ or radar monitor			Most routes circuitous			Some routes circuitous			Routings direct, minimum turns

COMMENTS: ____

____

____

2. ALTITUDE/SPEED RESTRICTIONS - Altitude and/or speed restrictions should only be considered when, in the rater's opinion, the number or severity of the restrictions would place an objectionable burden on either the pilot or controller.

1	2	3	4	5	6	7	8	9	10
Unrealistic altitude/ speed restrictions			Many altitude/ speed restrictions			Some altitude/ speed restrictions			No altitude/speed restrictions

COMMENTS: ____

____

____

RATING FORM cont'd

NAME OF RATER: ____________________ DIRECTION OF OPERATION: __________

3. RADAR VECTORING - The amount of radar vectoring that is required to guide aircraft through areas of limited maneuvering airspace.

1	2	3	4	5	6	7	8	9	10
System entirely dependent on radar vectors			System heavily dependent on radar vectors			System moderately dependent on radar vectors			Minimum radar vectors

COMMENTS: ____________________

____

____

4. COMMUNICATIONS CHANGES - The requirement to change from one frequency to another for control purposes. Consider only those changes that are obviously caused by less than optimum procedures or those necessitated by complex sectorization. Discount the change to, or from, the local controller or from an approach controller to a final controller.

1	2	3	4	5	6	7	8	9	10
All aircraft get more than one frequency change in terminal area			All aircraft require one frequency change in terminal area			A minimum of aircraft receive a frequency change in terminal area			No frequency change

COMMENTS: ____________________

____

____

5. NOISE ABATEMENT - Noise abatement is concerned with a plan which makes an effective use of noise abatement procedures.

1	2	3	4	5	6	7	8	9	10
Overly restrictive			Operationally restrictive			Meets current criteria			Operationally advantageous

COMMENTS: ____________________

____

____

RATING FORM cont'd

NAME OF RATER: ____________________ DIRECTION OF OPERATION: ________

6. INTERACTION - Interaction is the effect of one position's operation on another positions operation.

1 2 3	4 5 6	7 8 9	10
Interaction with another position precludes simultaneous operations	Interaction requiring considerable coordination to control traffic	Some interaction requiring minor coordination	No interaction

COMMENTS: ____________________

7. CONTROLLER WORKLOAD - Controller workload is concerned with the distribution and complexity of the operations in each sector of specialization.

1 2 3	4 5 6	7 8 9	10
Inequitable distribution of traffic and overly complex operations	Inequitable distribution of traffic and complex operations	Equitable distribution of traffic with average complexity	Equitable distribution of traffic, minimum complexity, with capacity to increase op'ns

COMMENTS: ____________________

8. AIRSPACE - Airspace is concerned with the vertical and the horizontal boundaries for each sector of specialization.

1 2 3	4 5 6	7 8 9	10
Inadequate airspace	Limited airspace requiring precise traffic flow planning	Adequate airspace for this traffic volume	Adequate airspace for 25% increase in volume

COMMENTS: ____________________

RATING FORM cont'd

NAME OF RATER: ____________________ DIRECTION OF OPERATION: __________

9. COORDINATION - In rating the plans with respect to coordination, consider the need for, amount of, and effect on the system and/or user.

1	2	3	4	5	6	7	8	9	10
Excessive inter/intra facility coordination			Heavy inter/intra facility coordination			Moderate inter/intra facility coordination			Minimum inter/ intra facility coordination

COMMENTS: ____

____

____

10. TRAFFIC MIX - Traffic mix is the degree of admixture of aircraft of differing capabilities within the same sector of specialization.

1	2	3	4	5	6	7	8	9	10
Heavy mix			Moderate mix			Light mix			Minimum mix

COMMENTS: ____

____

____

APPENDIX B

LAS VEGAS TERMINAL AREA, PRESENT-DAY OPERATION

APPENDIX B

LIST OF ILLUSTRATIONS

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RADAR CONTROL POSITIONS AND RESPONSIBILITIES

THE ARRIVAL CONTROL POSITION.

The arrival control position is responsible for sequencing and vectoring IFR arrival traffic either to the final approach course, for an instrument approach to the active runway, or to the traffic pattern, for a visual approach depending what operation is in effect (figures B-1 and B-2).

THE LAS LOW EAST POSITION.

The LAS Low East position is primarily responsible for sequencing VFR traffic inbound from the east to the runway(s) in use for category 1 and 2 aircraft in conjunction with the traffic sequenced by LAS West position. This position also controls VFR departures and IFR departures which initially enter this airspace and are not capable of flying the LAS SID's. The Low East position must separate traffic from the Nellis flow, coordinates with other sectors, local control, and Nellis when needed (figures B-3 and B-4).

THE LAS LOW WEST POSITION.

The LAS Low West position is primarily responsible for sequencing VFR traffic inbound from the west to the runway(s) in use for category 1 and 2 aircraft in conjunction with the traffic sequenced by LAS Low East position. This position also controls VFR departures and IFR departures which initially enter this airspace and are not capable of flying the LAS SID's. The LAS West position must separate traffic from the Nellis flow and also issue IFR clearances and discrete VFR codes to North Las Vegas Tower upon request. It also coordinates with other sectors, local control, and Nellis when needed (figures B-5 and B-6).

THE DEPARTURE RADAR POSITION.

The departure radar position is responsible for controlling IFR departures and pure jet VFR departures in assigned airspace as described according to runway in use. The departure position must insure that appropriate heavy-jet separation is maintained between aircraft under his control and VFR TCA aircraft. Nonjet IFR traffic is often integrated with the TCA traffic flow by the TCA sectors, and a handoff is made to the departure sector after coordination (figures B-7 and B-8).

THE NELLIS EAST POSITION.

The Nellis East position is responsible for controlling and sequencing all high-altitude penetrations and low-altitude arrivals and departures entering his delegated airspace for Nellis AFB. The Nellis East position must coordinate with Nellis AFB and any other affected intrafacility sectors as needed. This position issues clearances to Nellis AFB when runway 03 is in use (figure B-9).

THE NELLIS WEST POSITION.

The Nellis West position controls the arrival runway sequence for Nellis AFB and departures off Nellis entering its delegated airspace. The Nellis West position issues clearances to Nellis AFB when runway 21 is in use. This position must coordinate with Nellis AFB and any other affected intrafacility sectors as needed (figure B-10).

Note: The Nellis East and Nellis West position are located side by side in the TRACON and use the same radar display. Close coordination is required between the two positions, and, at times, the positions are combined, traffic permitting.

RADAR ARRIVAL PROCEDURES

RUNWAY 25/19 CONFIGURATION (LAS).

Three STAR's funnel IFR jet traffic to the airport. Traffic inbound from the west and south flows toward the Boulder City VORTAC and is radar vectored prior to or upon reaching the VORTAC to runway 25. The West inbound flow is known as the Fuzzy 1 arrival and the flow from the south is the Crescent 4 arrival. The remaining STAR is the Crowe One arrival which blends inbound traffic from the northeast, east, and southeast, generally blending by means of radar vectors, so the sequence is set in the vicinity of the Boulder VORTAC and proceeds straight in for runway 25 (figure B-11).

IFR nonjet traffic is routed over preferred arrival airways using altitude separation and is usually sequenced to runway 19 with TCA nonjet traffic. TCA traffic is routed parallel to IFR traffic, or altitude separation is used,and is sequenced by two low-altitude TCA radar sectors and integrated by coordination in a sequence to final on a downwind leg to runway 19.

RUNWAY 19 CONFIGURATION 2 (LAS).

For this runway configuration the same STAR's are applied to position IFR jet traffic in the vicinity of the Boulder VORTAC. From this point, radar vectoring is used to sequence traffic to runway 19L for a visual approach. IFR nonjet traffic is handled similarly to the runway 25 configuration (figure B-12).

TCA traffic is routed parallel to IFR traffic, or altitude separation is used. When coordinated with the IFR arrival sector, this TCA traffic may be sequenced with the jet traffic to runway 19L. During moderate-to-heavy traffic conditions, such coordination is not usually feasible, and the TCA traffic is routed across the airport at midfield to enter a right downwind for runway 19R.

RUNWAY 1 CONFIGURATION 3 (LAS).

IFR jet arrivals vectored off the STAR routes to a visual approach for runway 1R. Arrivals from the west may be routed over the airport and vectored to a

right downwind. Likewise, the arrivals from the south may continue the STAR until reaching the vicinity of Boulder VORTAC before being vectored into the arrival sequence (figure B-13).

TCA traffic is routed parallel to IFR traffic, and altitude separation is used more frequently. Visual separation is the rule of thumb once traffic is established on final. TCA traffic may be sequenced with the jet traffic to runway 1R if the IFR sector is not working moderate-to-heavy traffic. When coordination is not feasible, the TCA traffic may be routed across the airport at midfield to enter a left downwind for runway 1L or a crossover accomplished southeast of the airport using altitude separation for a base leg entry to runway 1L.

Las Vegas runway 25/19 Nellis runway 03 configuration 4 is shown in figure B-14.

The LAS IFR and VFR traffic is controlled in the same manner as described under configuration 1. Nellis traffic is controlled in the same manner.

RADAR DEPARTURE PROCEDURES

RUNWAY 25/19 CONFIGURATION (LAS).

1. All IFR jet departures climb to 15,000 and are radar vectored to the SID's. This accomplishes noise abatement and initial altitude separation from TCA traffic (figure B-11).

a. Oveto Two Departure. Climb runway heading for vectors to LAS R-039 (normally a right turn out) to Oveto DME fix, then via transition or assigned route.

b. Mead Three Departure. Climb runway heading for vectors to Boulder City VORTAC (normally a right turn out), then via transition or assigned route.

c. Hidden Hills Four Departure. For runway 25, maintain runway heading until 2-nmi DME, turn left, intercept LAS 211R, and resume navigation to Goodsprings. For runway 19, maintain runway heading until 3-nmi DME, turn right, intercept LAS 211R, and resume navigation to Goodsprings. After passing 9,500 feet at Goodsprings, continue climb, turn right 260° to intercept, and proceed via Beatty VORTAC R-126 to Hidden Hills, then via transition or assigned route.

d. Goodsprings Two Departure. For runway 25, maintain runway heading until 2-nmi DME, turn left, intercept LAS 211R, and resume navigation to Goodsprings. For runway 19, maintain runway heading until 3-nmi DME, turn right, intercept LAS 211R, and resume navigation to Goodsprings. Then via transition or assigned route to Daggett, Hector, or Goffs. There is one McCarran IFR departure sector; however, nonjet IFR traffic is often integrated with the TCA traffic flow by the TCA sectors, and a handoff is made to the departure sector after coordination.

TCA departures are separated from IFR traffic by altitude and/or routings. Local terrain dictates a two-way flow of TCA traffic over most of the natural flyways into and out of the valley. These arrivals and departures are usually separated by altitude (see TCA AR/DR routes).

RUNWAY 19 CONFIGURATION (LAS).

1. IFR and TCA departure flows are much the same as the runway 25 configuration, except jet aircraft share runway 19L with the general aviation aircraft, which slows the operation to some extent due to TCA departures turning across the jet departure course and having to meet the wake turbulence criteria (figure B-12).

RUNWAY 01 CONFIGURATION (LAS).

1. IFR jet departure flows are much the same as the runway 25 configuration. Nonjet IFR traffic is usually integrated with the TCA traffic flow (figure B-13).

2. TCA departures are separated from IFR traffic by altitude, since the routes are initially the same for the first 4 to 5 nmi. The TCA departure flow is considerably slower on this configuration due to the displaced thresholds and the separation criteria which must be applied. The jet and larger general aviation traffic share runway 01R, requiring additional spacing to accomplish departure crossover and having to meet the wake turbulence criteria.

PRESENT SYSTEM NELLIS AFB (LSV)

ARRIVAL AND DEPARTURE PROCEDURES.

1. Runway 21 Configuration

a. An east/west airspace split between the two Nellis radar sectors located at the Las Vegas TRACON enables each sector to handle one of the two primary VFR arrival fixes; i.e., Sally and Lee. All high-altitude penetrations are controlled by the East Nellis sector. Low-altitude arrivals are initially controlled by the sector which owns the airspace. Approximately 75 percent of the Nellis traffic uses stereotyped VFR arrival/departure procedures. Most of the stereotyped arrivals are "pop-up" traffic at Sally or Lee. The Lee recovery is usually worked by the west sector, with the east sector calling the sequence.

b. Most of the time, the Nellis operation is divided between the two positions, with one controller acting as a coordinator for the other, which is doing the actual recovery controlling of inbound traffic, sequencing for GCA approaches (full stop or practice) and vectoring when necessary to the final approach course before releasing the aircraft to either GCA or Nellis Tower. When necessary to split the sector between east or west arrival, the east controller normally handles the practice approaches (figure B-11).

2. Runway 03 Configuration

a. Runway 03 is a flip-flop operation, and the controllers simply change hands. The west sector becomes the arrival sector, and the east sector becomes the departure sector. This is accomplished easily, as the radiofrequencies are available at both positions, and when a runway change occurs, the frequencies merely change hands. The operation, as explained in the narrative, is essentially the same for both runway 21 and 03, the only significant difference being the roles of the arrival and departure controllers alternating with the change of the runways (figure B-13).

TCA AR/DR ROUTES

VFR DEPARTURE ROUTES.

a. Departing Runway 19 or 25

1. Canyon Departure. After takeoff, fly heading 100° to the Henderson Cutoff (State Highway 40) at or below 3,000 m.s.l. Thence proceed direct to Boulder City VORTAC climbing to 5,500 m.s.l. Departing the TCA at Boulder City VORTAC, squawk 1200. Radar service will automatically be terminated.

2. Substation Departure. After takeoff, turn right, fly direct to the Charleston Substation climbing to 3,600 m.s.l. Departing the TCA at Charleston Substation, squawk 1200. Radar service will automatically be terminated.

b. Departing Runway 1 or 7

1. Winterwood Departure. After takeoff, fly direct to the Winterwood Golf Course at or below 3,500 m.s.l. Thence direct Vegas Wash Marina climbing to 5,500 m.s.l. Departing the TCA at Vegas Wash Marina, squawk 1200. Radar service will automatically be terminated.

2. Substation Departure. After takeoff, turn left, fly direct to the Charleston Substation climbing to 3,500 m.s.l. Departing the TCA at Charleston Substation, squawk 1200. Radar service will automatically be terminated.

VFR ARRIVAL ROUTES.

a. Landing Runway 19 or 25

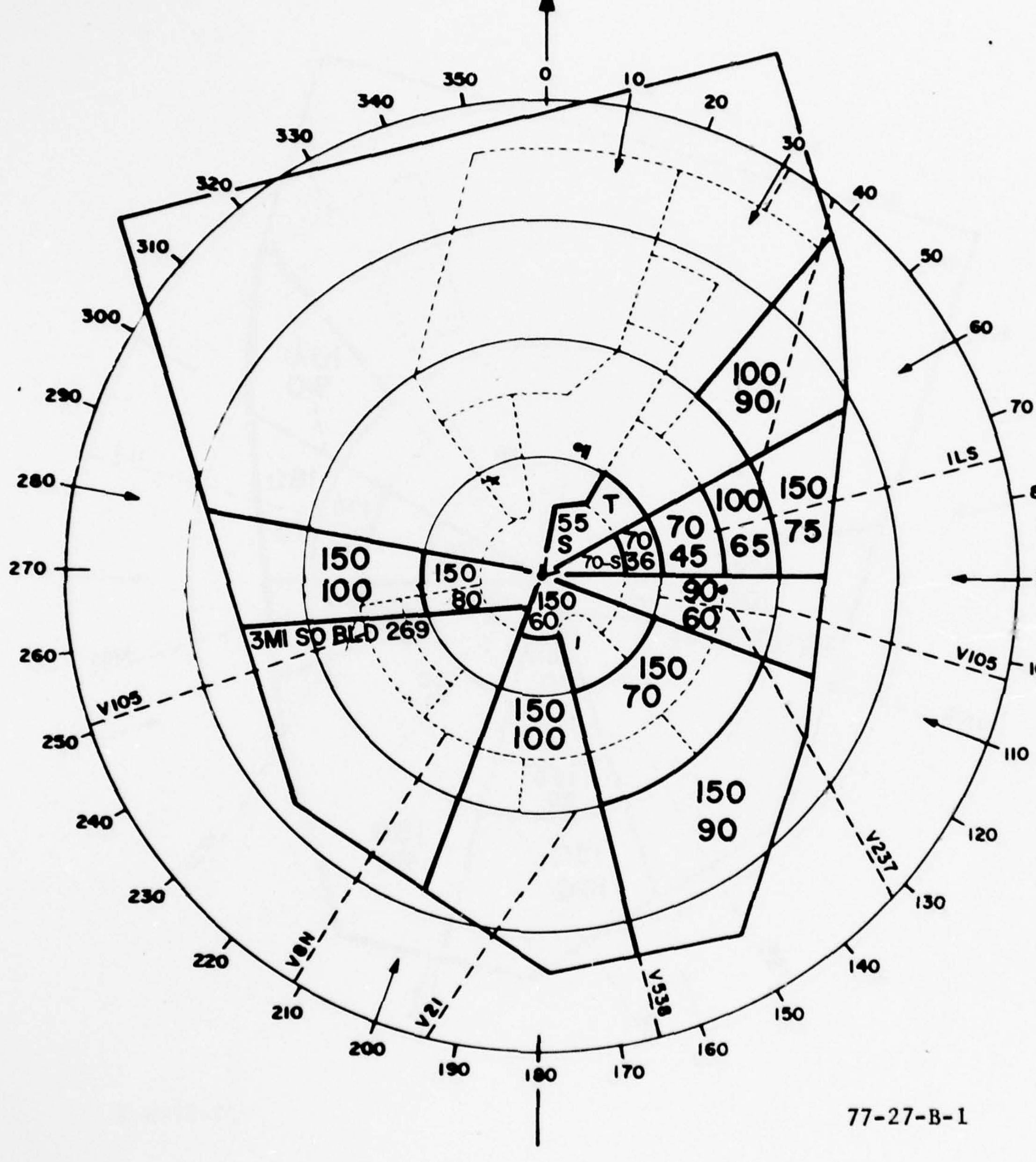
1. Winterwood Arrival. Depart Vegas Wash Marina at or below 5,500 m.s.l. descending direct Winterwood Golf Course. Cross Winterwood Golf Course at or below 3,500 m.s.l. for base leg entry to runways 19 or 25.

b. Landing Runway 1 or 7

1. Canyon Arrival. Depart Boulder City VORTAC at or below 5,500 m.s.l. descending direct Henderson. Cross Henderson at or below 3,500 m.s.l. for downwind or base leg entry to runways 1 or 7.

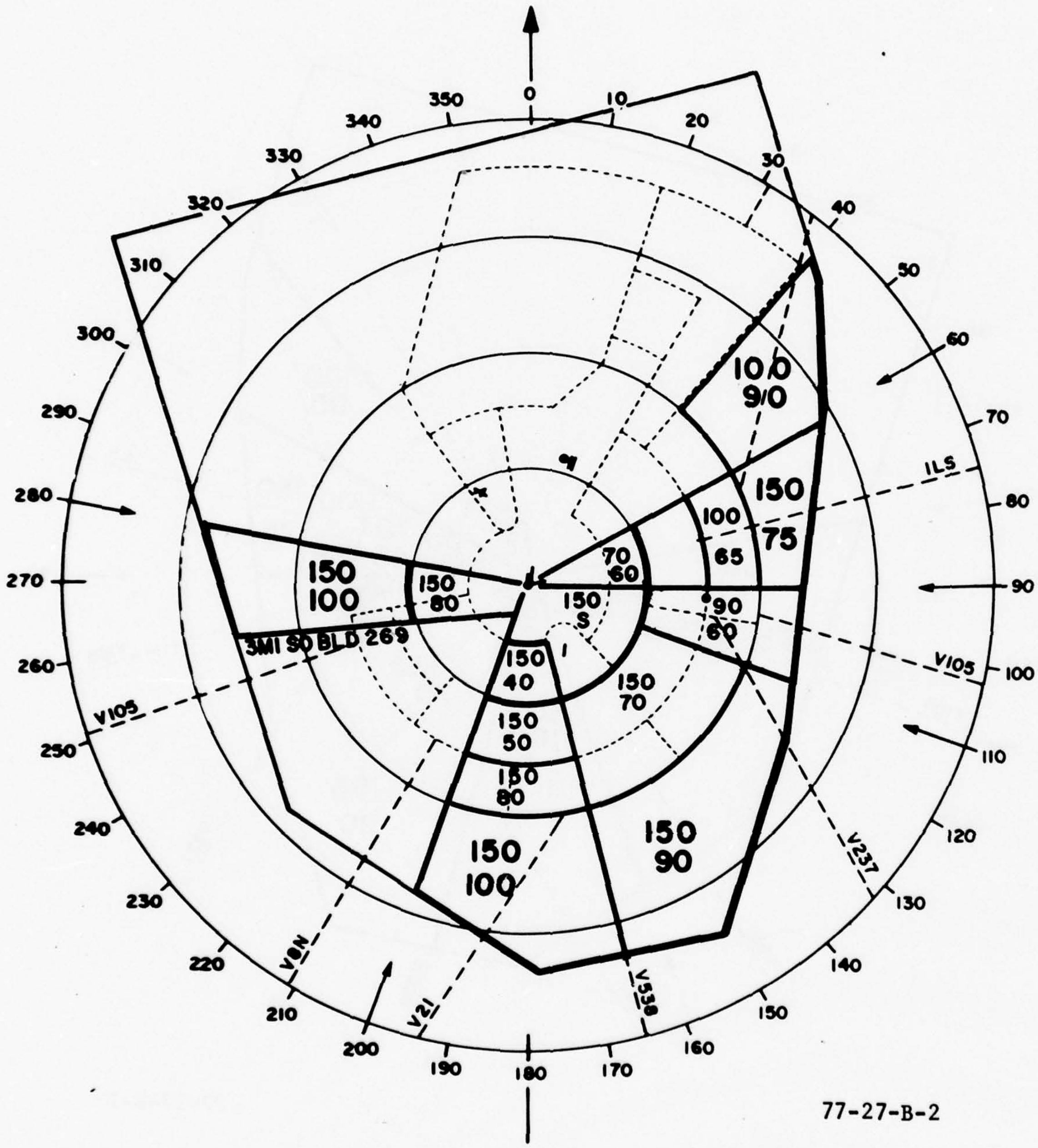
c. Landing Runways 19-25-1 or 7

1. Substation Arrival. Depart Charleston Substation at 4,000 m.s.l. heading 090° for entry to the traffic pattern runways 19-25-1 or 7.



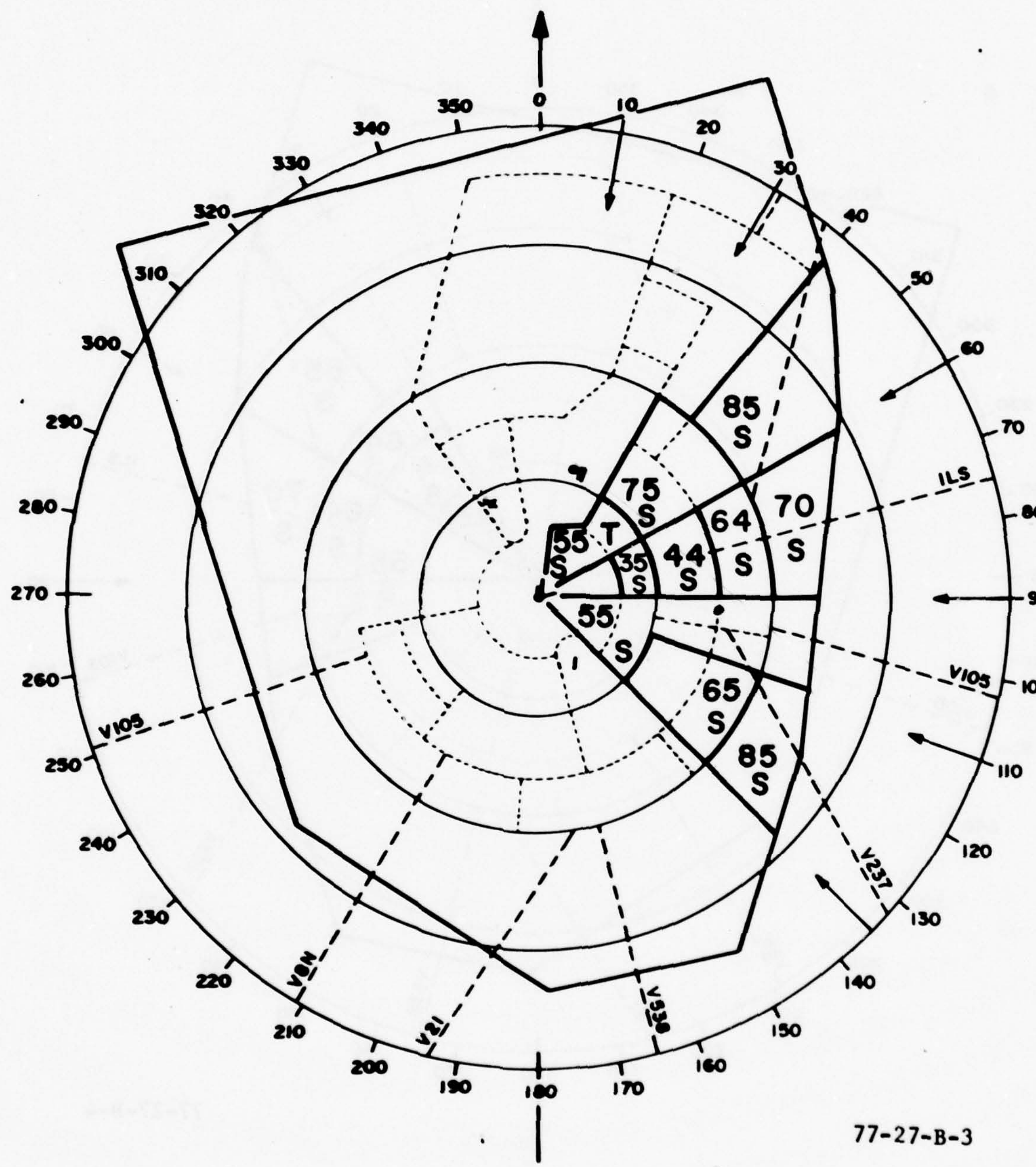
77-27-B-1

FIGURE B-1. SECTORIZATION CHART--ARRIVAL CONTROLLER--RUNWAY 25 AND 19



77-27-B-2

FIGURE B-2. SECTORIZATION CHART--ARRIVAL CONTROLLER--RUNWAY 01



77-27-B-3

FIGURE B-3. SECTORIZATION CHART--LOW EAST--RUNWAY 25 AND 19

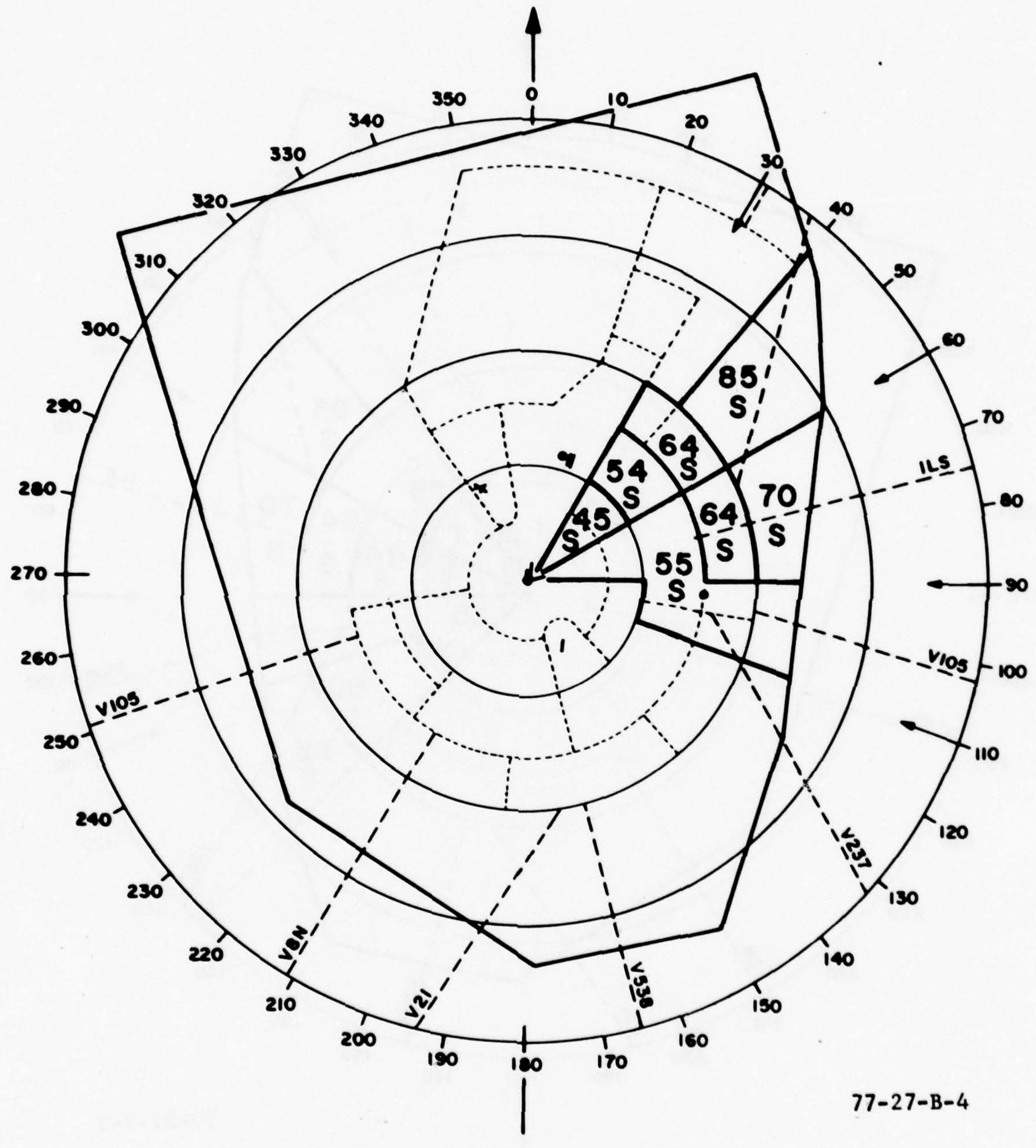
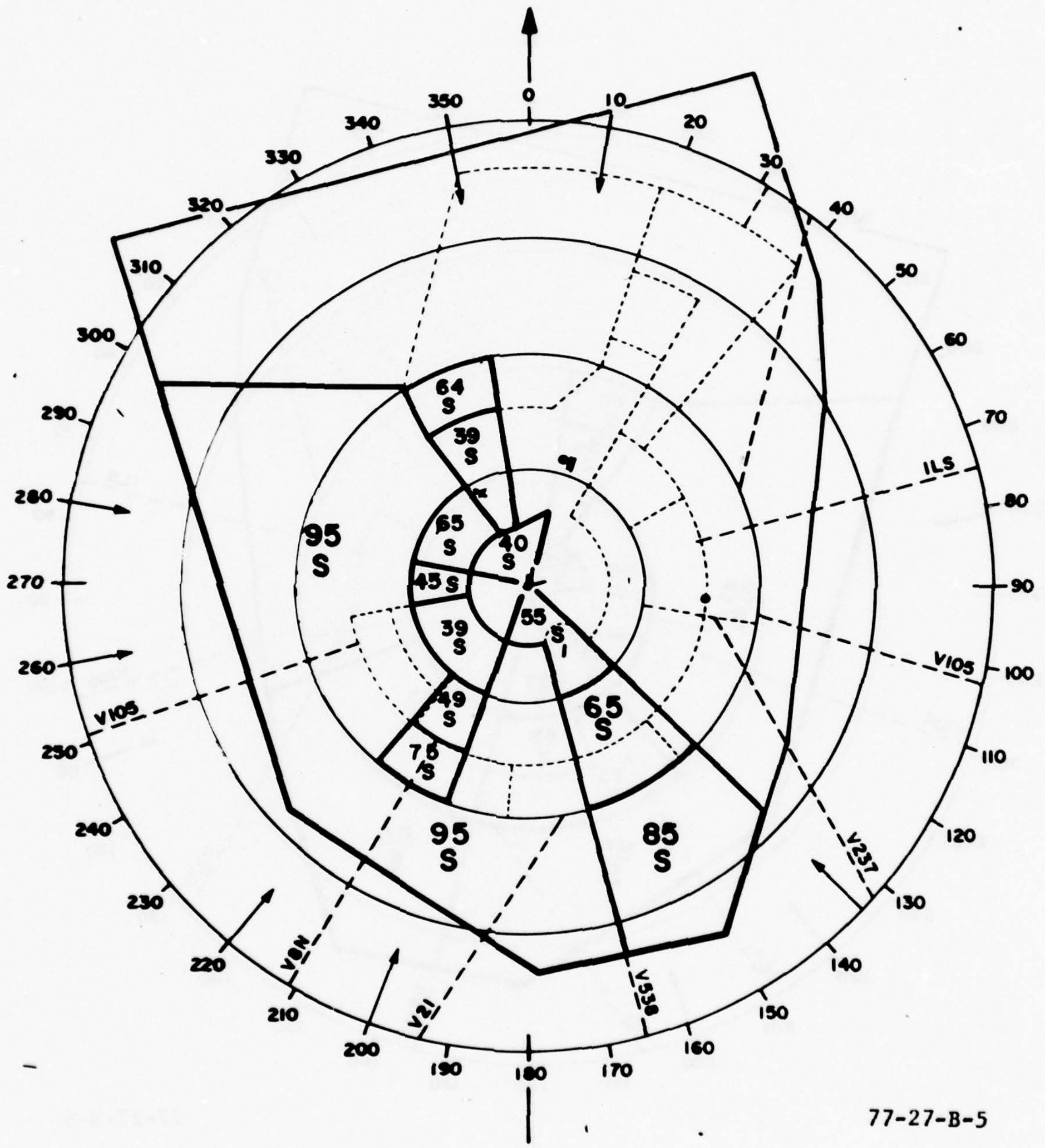


FIGURE B-4. SECTORIZATION CHART--LOW EAST--RUNWAY 01



77-27-B-5

FIGURE B-5. SECTORIZATION CHART--LOW WEST--RUNWAY 25 AND 19

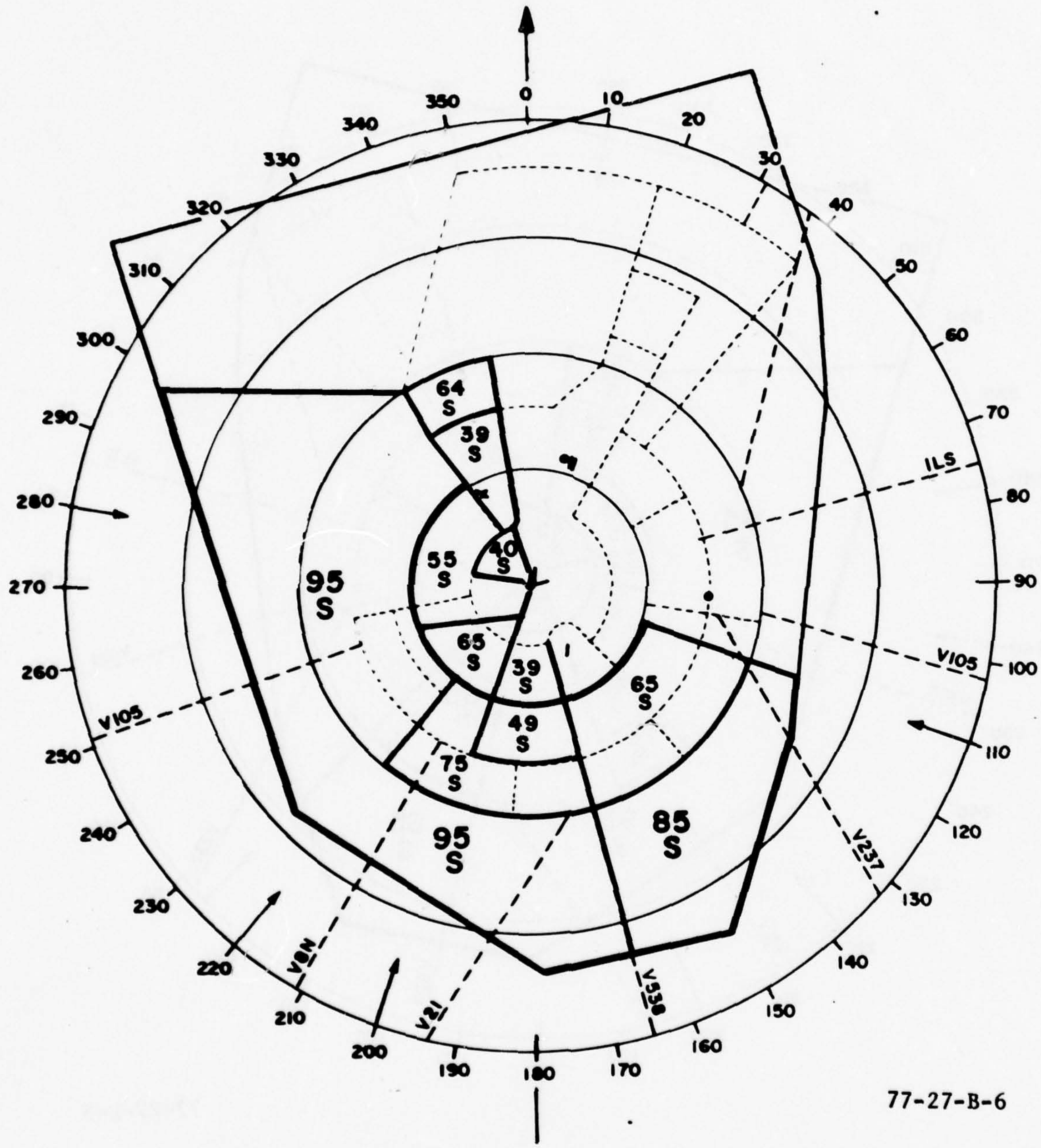
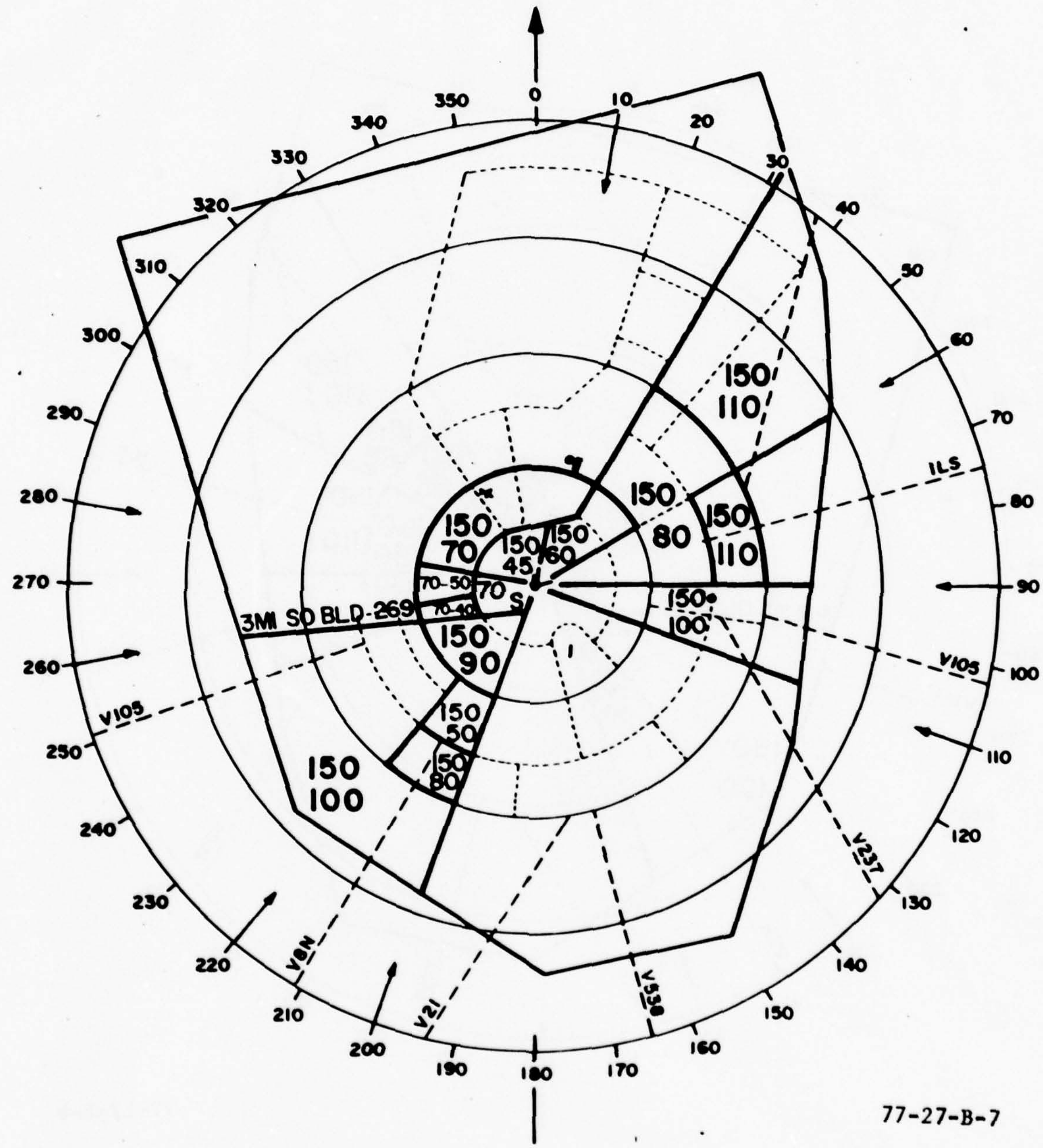
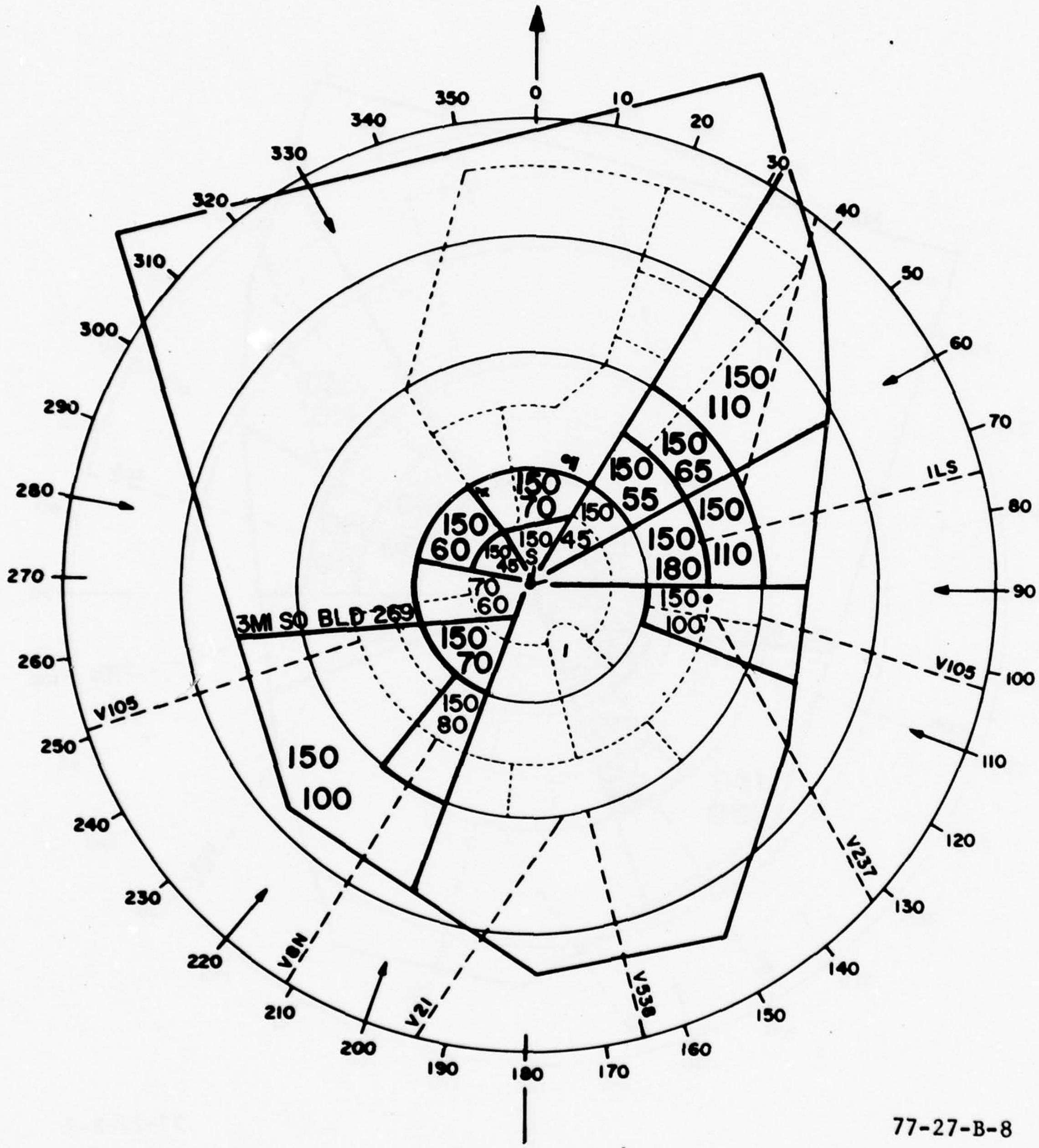


FIGURE B-6. SECTORIZATION CHART--LOW WEST--RUNWAY 01



77-27-B-7

FIGURE B-7. SECTORIZATION CHART--DEPARTURE CONTROLLER--RUNWAY 25 AND 19



77-27-B-8

FIGURE B-8. SECTORIZATION CHART--DEPARTURE CONTROLLER--RUNWAY 01

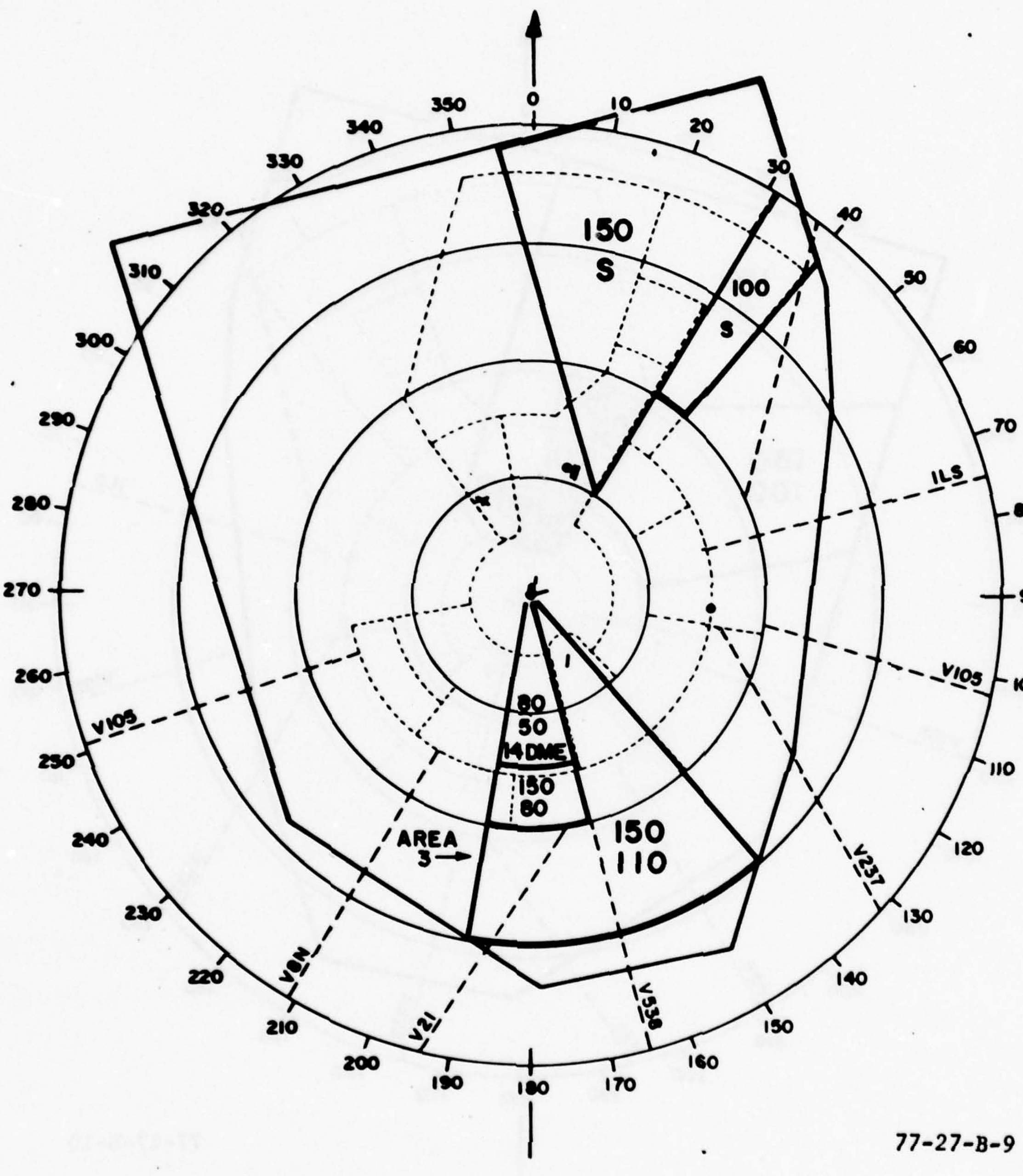
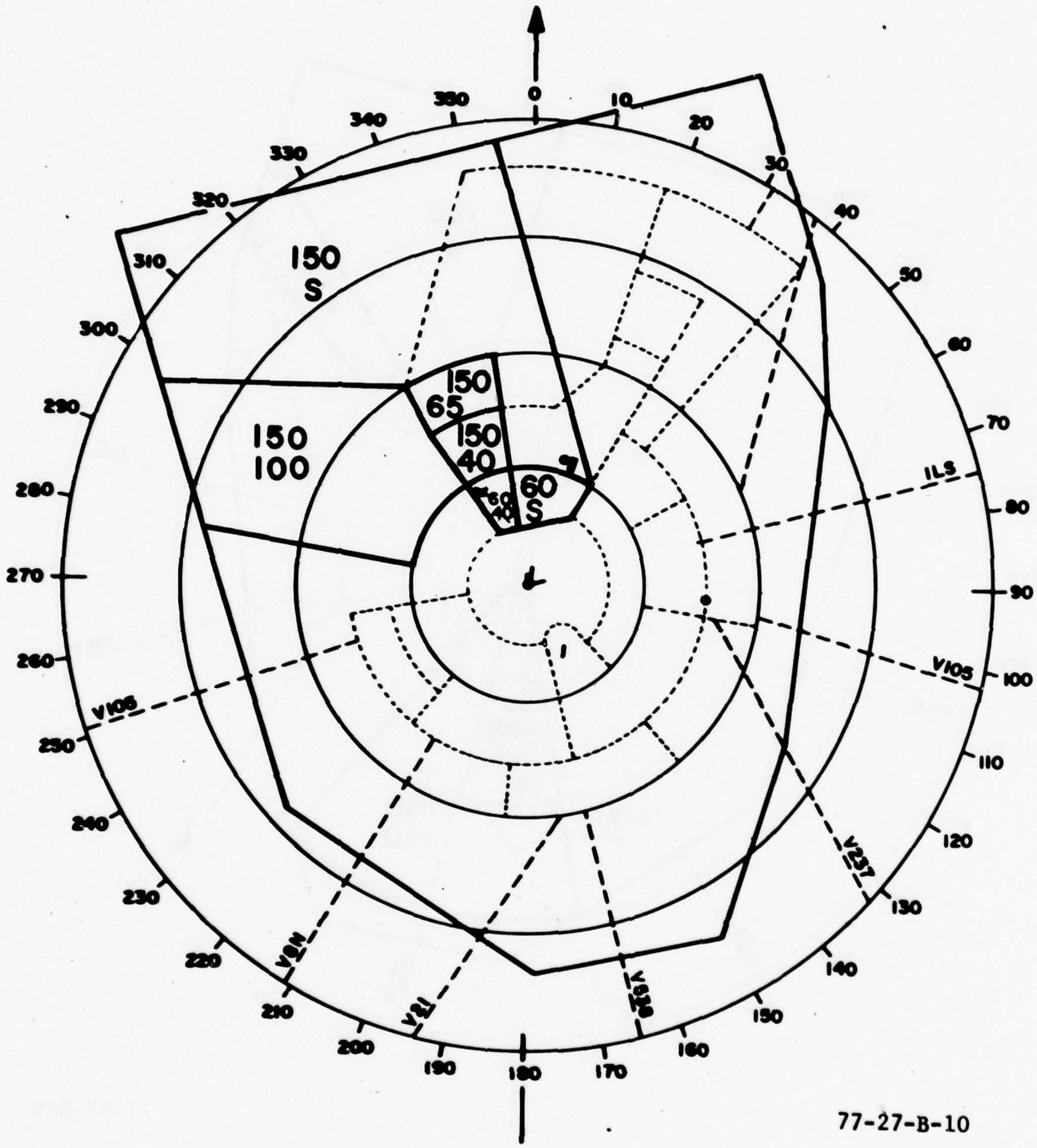


FIGURE B-9. SECTORIZATION CHART--NELLIS EAST CONTROLLER



77-27-B-10

FIGURE B-10. SECTORIZATION CHART--NELLIS WEST CONTROLLER

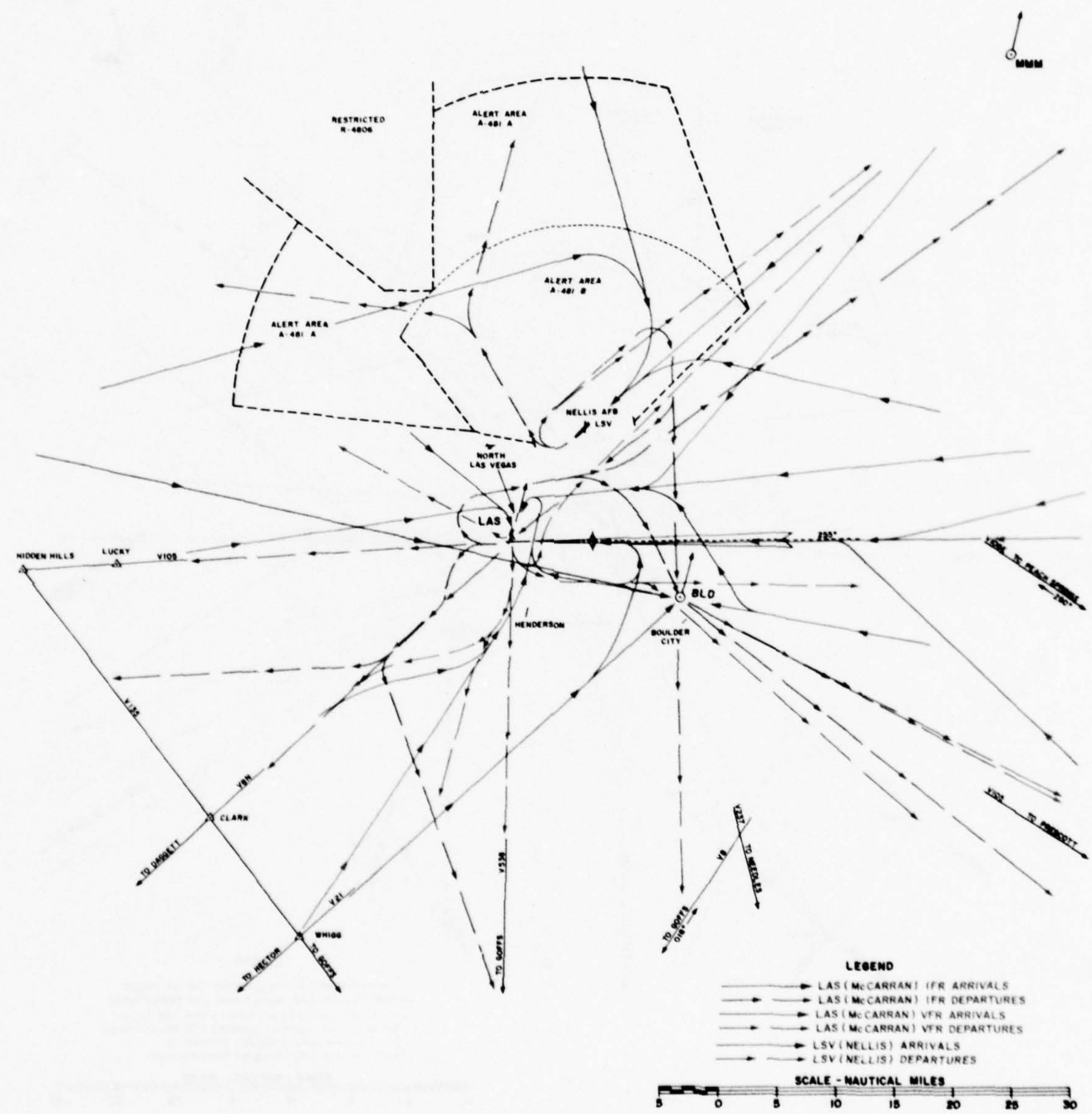


FIGURE B-11. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 21R/21L (CONFIGURATION 1)

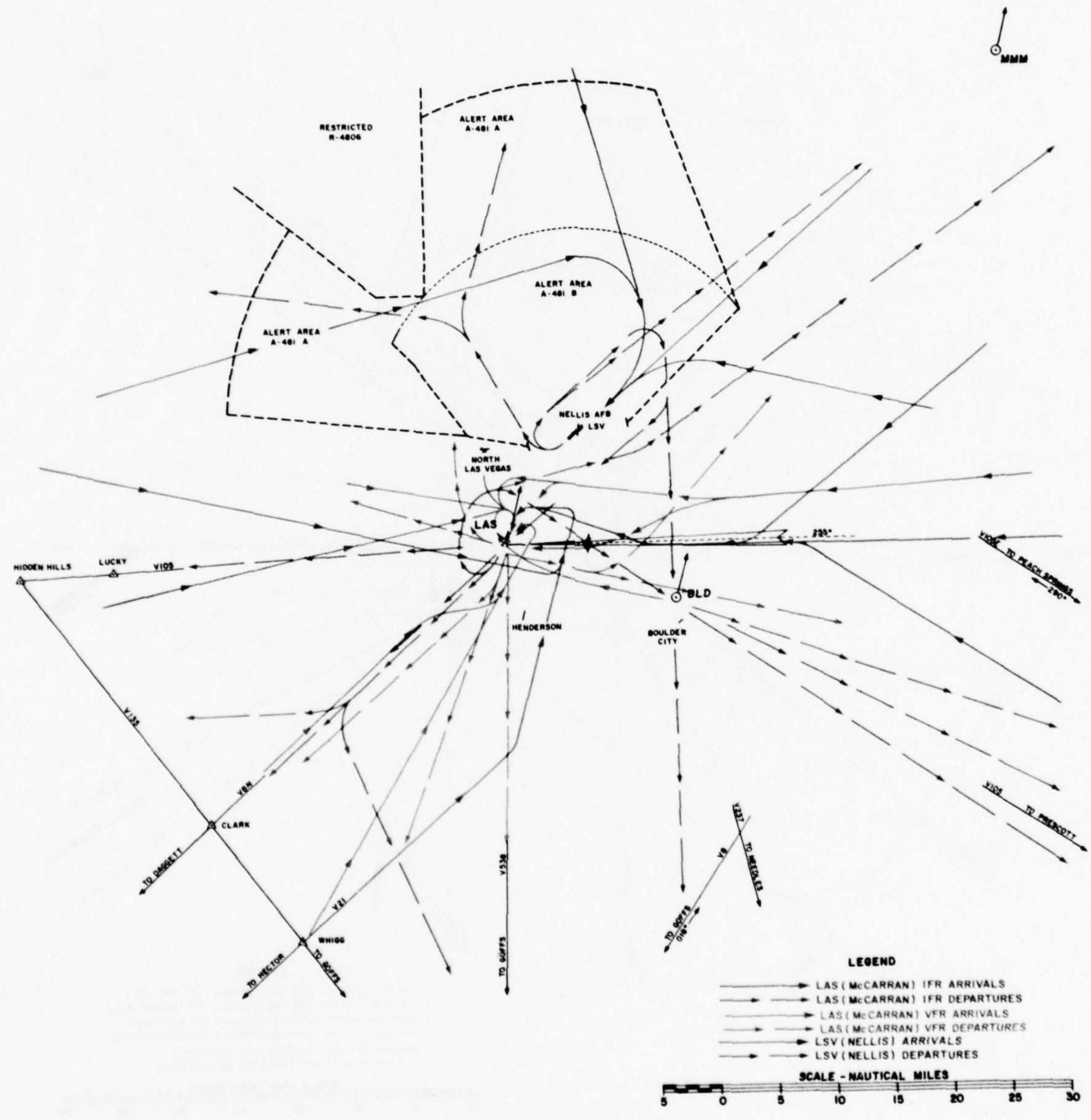


FIGURE B-12. FLOW CHART--LAS RUNWAYS 19R/19L, LSV RUNWAYS 21R/21L (CONFIGURATION 2)

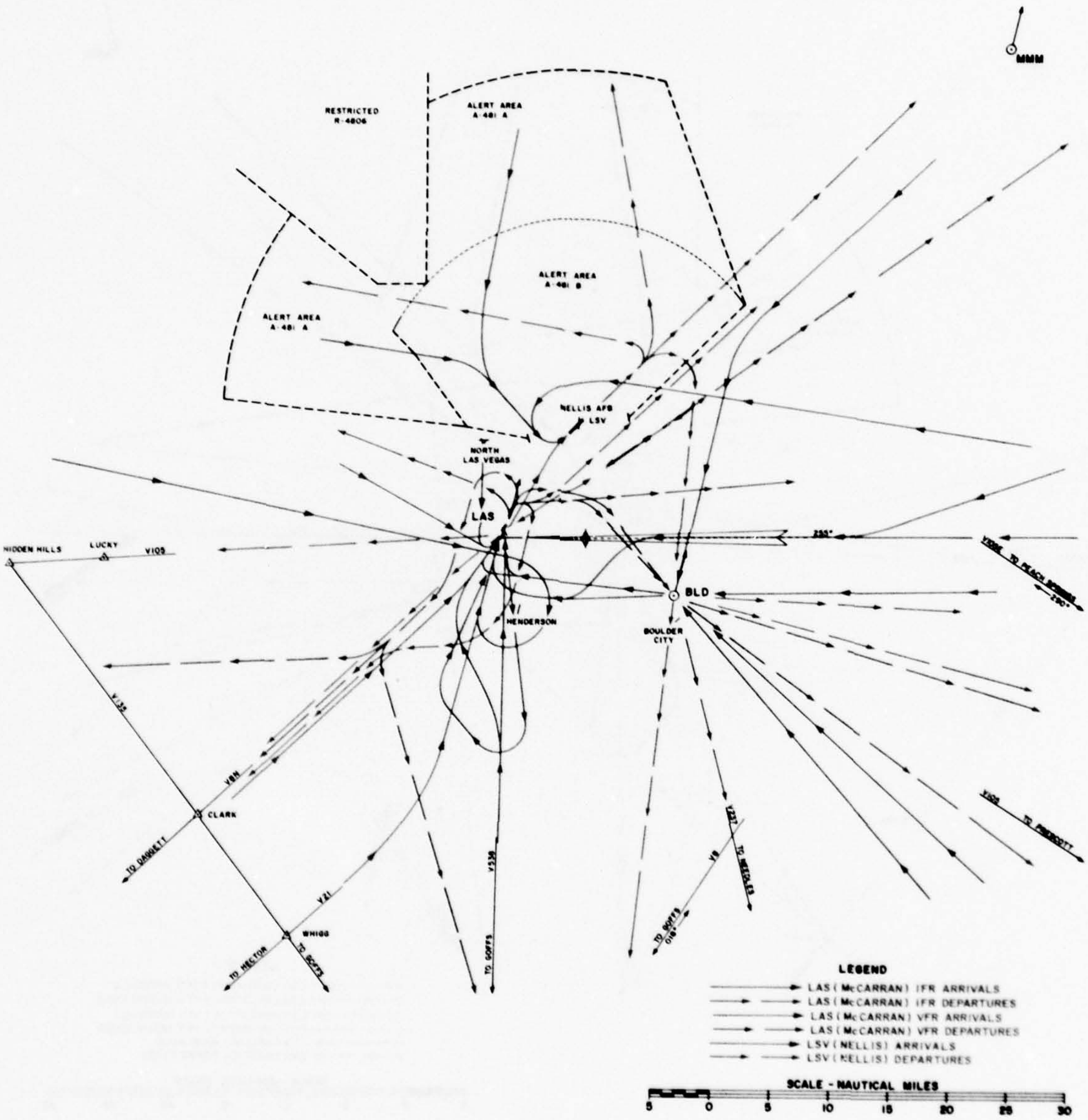


FIGURE B-13. FLOW CHART--LAS RUNWAYS 01R/01L, LSV 03R/03L (CONFIGURATION 3)

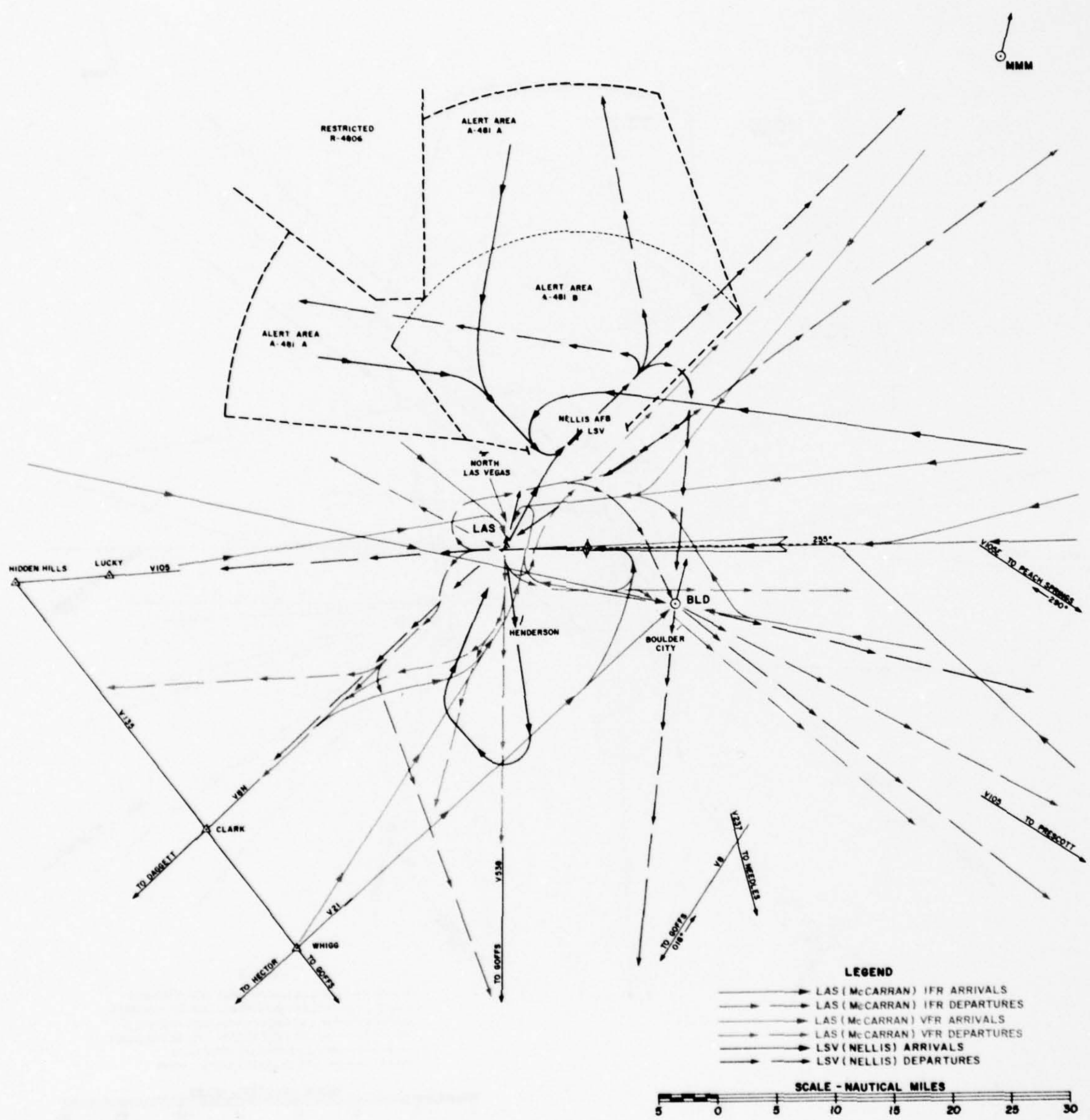


FIGURE B-14. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 03R/03L (CONFIGURATION 4)

APPENDIX C

LAS VEGAS TERMINAL AREA, PLAN 1 OPERATION

APPENDIX C

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LAS VEGAS TERMINAL AREA, PLAN 1 OPERATION

POSITION DESCRIPTION.

A. Arrival Controller (figures C-1, C-2, and C-3)

1. Responsible for sequencing and vectoring IFR arrival traffic either to the final approach course for an instrument approach to the active runway or to the traffic pattern for a visual approach depending on the configuration in affect.

B. LAS Low East Controller (figure C-4)

1. Responsible for sequencing VFR traffic inbound from the east to the runway(s) in use for category I and II aircraft in conjunction with the traffic sequenced by LAS Low West position. This position also controls VFR departures and IFR departures which initially enter his airspace and are not capable of flying the LAS SID's. This position must separate traffic from Nellis flow. Coordinate with other sectors, local control, and Nellis AFB when needed.

C. LAS Low West Controller (figures C-4, C-5, C-6, C-7, and C-8)

1. Responsible for sequencing VFR traffic inbound flights from the west to the runway(s) in use for category I and II aircraft in conjunction with the traffic sequenced by LAS Low East position. This position also controls VFR departures and IFR departures which initially enter his airspace and are not capable of flying the LAS SID's. This position must separate traffic from Nellis flow and also issue IFR clearances and discrete VFR codes to North Las Vegas Tower upon request, and coordinates with other sectors, local control, and Nellis AFB when needed.

D. Radar Departure Controller (figures C-8, C-9, and C-10)

1. Responsible for controlling IFR departures and pure jet VFR departures in assigned airspace as described according to runway in use. The position must insure appropriate heavy-jet separation is maintained between aircraft under his control and VFR TCA aircraft. Nonjet IFR traffic is often integrated with the TCA traffic flow by the TCA sectors, and a handoff is made to the departure sector after coordination.

E. Final Controller

1. Runway 19L (figure C-6)

a. Receives handoffs on IFR traffic from the Arrival controller.

b. Receives handoffs on VFR traffic from ERS controller (see item F inbound) from north through south.

2. Runway 1L (figure C-5)

a. West Final controller sequences both IFR and VFR aircraft.

(1) Receives handoffs on IFR traffic from the Arrival controller.

(2) Receives handoffs on VFR/TCA traffic from the ERS controller.

3. Runway 1R (figure C-7)

a. East Final controller sequences both IFR and VFR aircraft.

(1) Receives handoffs on IFR traffic from the Arrival aircraft.

(2) Receives handoffs on VFR/TCA traffic from the ERS controller.

4. IFR feeder fixes

a. Fuzzy intersection

b. Whigg intersection

c. Goffs VOR

d. Winds intersection

e. Crowe intersection

f. Mormon Mesa VOR

F. ERS Controller (figures C-11, C-12, and C-13)

1. Establishes initial identification and sequencing of VFR arrivals to LAS. Handoff to the low positions is accomplished at the following VFR feeder fixes:

a. Vegas Wash intersection (West tip of Lake Mead)

b. Boulder intersection (BL Dainport or VOR)

c. Crescent intersection (V21 and V538)

d. Lone Mountain intersection (Over Lone Mountain)

G. Low Southeast Controller (figure C-6)

1. This position activated when using runway configuration 19. The controller will work all east, north, and south TCA departures as well as TCA arrivals from the south and east that the Final controller cannot work at a given time. Depending on traffic situations, handoffs are given to the Final controller for runway 19L or to Low West for runway 19R. Handoffs will be received from the ERS controller at the appropriate VFR feeder fixes.

H. LSV East Controller (figure C-14)

1. Responsible for controlling and sequencing all high-altitude penetrations and low-altitude arrivals and departures entering the delegated airspace for Nellis AFB. This position must coordinate with Nellis AFB and any other affected intrafacility sectors as needed and issues clearances to Nellis AFB when runway 03 in use.

I. LSV West Controller (figure C-14)

1. Responsible for the arrival running sequence for Nellis AFB and departures off Nellis entering his delegated airspace. This controller issues clearances to Nellis AFB when runway 21 is in use and coordinates with Nellis AFB and any other affected intrafacility sectors as needed.

Note: The Nellis East and Nellis West positions are located side by side in the TRACON and use the same radar display. Close coordination is required between the two positions and at times the positions are combined, traffic permitting.

CONFIGURATION 1 LAS RUNWAYS 25/19 LSV RUNWAYS 21R/21L (FIGURE C-15).

LAS ARRIVALS.

A. Three STAR's funnel IFR jet traffic to the airport. Traffic inbound from the west and south flows toward the Boulder City VORTAC and is radar vectored prior to or upon reaching the VORTAC to runway 25. The west inbound flow is known as the Fuzzy 1 arrival, and the flow from the south is the Crescent 4 arrival. The remaining STAR is the Crowe One arrival, which blends inbound traffic from the northeast, east, and southeast. The arrival controller will sequence all jet IFR aircraft to LAS for runway 25 by blending traffic in the vicinity of the Boulder VORTAC. Small, slow general aviation IFR aircraft not compatible with air carriers will be handed off to the appropriate Low position for sequencing to runway 19.

B. TCA traffic will be handed off to Low East and Low West from the ERS position (see General, F.) with East sequencing to 19L, and West to 19R.

C. Air Taxi Routes

1. Winterwood arrival

a. Depart Vegas Wash Marina at or below 5,500 m.s.l. descending direct Winterwood Golf Course. Cross Winterwood Golf Course at or below 3,500 m.s.l. for base leg entry to runways 25 or 19.

2. Substation arrival

a. Depart Charleston Substation at 4,000 m.s.l. heading 090° for entry to the traffic pattern for runways 25, 19, or 1.

LSV ARRIVALS.

A. An east/west airspace split between the two Nellis radar sectors located at the LAS TRACON enables each sector to handle one of the two primary VFR arrival fixes; i.e., Sally and Lee. All high-altitude penetrations are controlled by the East Nellis sector. Low-altitude arrivals are initially controlled by the sector which owns the airspace. Approximately 75° of the Nellis traffic uses stereotyped VFR arrival/departure procedures. Most of the arrivals are "pop-up" traffic at Sally or Lee, with the Lee recovery worked by West, while East calls the sequence.

B. Most of the time the Nellis operation is combined between the two positions, with one controller acting as a coordinator, while the other controller is working the actual recovery of inbound aircraft. The recovery aircraft is sequenced for GCA approaches (full stop or practice) or vectored to the final approach course before releasing the aircraft to either GCA or Nellis tower. When necessary to split the sector between east or west arrival, the East controller normally handles the practice approaches.

LSV STEREO RECOVERY ROUTE.

A. Lee Recovery

1. Depart Lee at 12,000 to 14,000 feet heading 060°. After passing LAS 360/20, turn right heading 135°. After passing Apex, turn right to initial descending to 3,500 feet. This recovery will be kept high and restricted above the departures at all critical crossing points.

B. Sally Recovery

1. Depart Sally at 12,000 to 14,000 feet heading 155°. After passing Apex, turn right to initial descending to 3,500 feet. This recovery will be kept high and restricted above the departures at all critical crossing points.

LAS DEPARTURE.

A. Departure control will vector all IFR high-performance aircraft to the appropriate exit fix (figures C-16 and C-17) via the Las Vegas One Departure.

B. Low East will work all east and northeast TCA departures and those IFR aircraft that do not meet the high-performance category.

C. Low West will work west and south TCA departures and those IFR aircraft that do not meet a high-performance category.

D. Any TCA departures requiring additional advisories outside the confines of the Low sectors will be handed off to the ERS position.

E. Las Vegas One Departure

1. Replaces all SID's and dictates that all aircraft will maintain runway heading for vectors to the appropriate exit fix as shown on the outbound strip. The exit fixes are as follows:

a. Gunnison (GUC)
b. Peach Springs (PGS)
c. Beatty (BTY)
d. Daggett (DAG)
e. Hector (HEC)
f. Goffs (GFS)
g. Prescott (PRC)

F. Air Taxi Routes

1. Canyon Departure

a. After takeoff, fly heading 100° to the Henderson Cutoff (State Highway 40) at or below 3,000 m.s.l. Thence proceed direct to BLD VORTAC climbing to 5,500 m.s.l. to depart TCA.

2. Substation Departure

a. After takeoff, turn right, fly direct to Charleston Substation climbing to 3,500 m.s.l. to depart TCA.

LSV DEPARTURES.

A. Casino Two Departure

1. Proceed via runway heading until 7.8 DME LAS. Turn right, heading 060°, to intercept LAS 018 radial 15 DME. Thence via (transition) or (assigned route), cross LAS 10 DME arc northbound at or below 6,000 feet. For south transitions, intercept LAS 039 radial at or above 7,000 feet.

B. Nellis Two Departure

1. Maintain runway heading until 4 DME. Turn right, heading 050°, to intercept and proceed outbound via LSV 025 radial to Garbs intersection. Thence via (transition) or (assigned route), cross LSV 253 radial at or below 6,000 feet. Cross LSV 025 radial 12 DME at or above 5,000 feet. Cross Garbs int. at or above 8,000 feet.

C. Sunrise One Departure

1. Proceed via direct LAS, then via LAS 066 radial to KIDS int. Cross KIDS int. at or above 5,000 feet. Thence via (transition) or (assigned route).

LSV STEREO DEPARTURE ROUTE.

A. Kraig Three Departure

1. Turn right within 1.5 nmi direct to Kraig. After passing Kraig turn right to 330° and proceed to Gass; thence, via appropriate transition. This departure will be restricted and tunneled beneath the Lee and Sally recoveries.

a. Gass Transition--after Gass, left turn to heading 265°.

b. Sally Transition--after Gass, right turn to 010° and continue to Sally.

CONFIGURATION 2 LAS RUNWAY 19R/19L LSV RUNWAY 21R/21L (FIGURE C-16).

LAS ARRIVALS.

A. This runway configuration uses the same STAR's to position IFR jet traffic, in the vicinity of the Boulder VORTAC, similar to configuration 1. The Arrival controller will sequence all IFR aircraft to LAS, handing them off to the Final controller for runway 19L.

B. ERS will sequence all VFR arrivals to LAS and hand off to the Final controller if inbound from the north through south, or to the Low West controller if from the south through northwest. The Low West position will sequence aircraft to runway 19R.

C. Low southeast will sequence aircraft to 19L from the Final controller or run arrivals over LAS at 4,000 feet for handoff to Low West for 19R. ERS will handoff to this sector over the appropriate VFR feeder fixes.

D. Air Taxi Routes

1. Winterwood Arrival (same as configuration 1)

2. Substation Arrival (same as configuration 1)

LSV ARRIVALS (same as configuration 1)

LSV STEREO RECOVERY ROUTES (same as configuration 1)

LAS DEPARTURES

A. IFR and TCA departure flows are much the same as the configuration 1 runway 25 operation except jet aircraft share runway 19L with general aviation aircraft.

B. Departure control will vector all IFR high-performance aircraft to the appropriate exit fix via the Las Vegas One Departure (configuration 1).

C. Low West will work only westbound TCA departures.

D. Low Southeast will work the east and south TCA departures.

E. Air Taxi Routes

1. Canyon Departure (same as configuration 1).
2. Substation Departure (same as configuration 1).

LSV DEPARTURES (same as configuration 1)

LSV STEREO DEPARTURE ROUTE. (Same as configuration 1, figure C-15)

CONFIGURATION 3 LAS RUNWAY 1R/1L LSV RUNWAY 3R/3L.

LAS ARRIVALS.

A. East Final controller will sequence IFR and VFR to 1R.

B. West Final controller will sequence IFR and VFR to 1L.

C. Arrival controller will handoff all IFR aircraft to appropriate final controller.

D. ERS will handoff all VFR/TCA aircraft to appropriate Final controller.

E. Air Taxi Routes

1. Canyon Arrival

a. Depart BLD VORTAC at or below 5,500 m.s.l. descending direct Henderson. Cross Henderson at or below 3,500 m.s.l. for downwind or base leg entry to runway 1.

2. Substation arrival (see configuration 1).

LSV ARRIVALS.

A. This configuration is a "flip-flop" operation (from runway 21, see configuration 1) where the controllers simply change positions. The West sector becomes arrival and East becomes departure. This is accomplished easily as the frequencies are available at both positions. The operation is essentially the same for both runway 21 and 3, with the only significant difference being the roles of arrival and departure--they alternate with the change of runways.

B. IFR arrivals will normally be given a vector to the traffic pattern for a visual approach.

LSV STEREO RECOVERY ROUTES.

A. Lee Recovery

1. Depart Lee heading 080° to Tule Springs. Turn right to 110°, then after passing L.V. Blvd., turn left to initial descending to 3,500 feet. This recovery will be kept high and restricted above the departure at all critical crossing points.

B. Sally Recovery

1. Depart Sally at 12,000 to 14,000 feet, heading 190°. After Tule Springs, turn left heading 100°, then after passing L.V. Blvds., turn left to initial descending to 3,500 feet. This recovery will be kept high and restricted above the departure at all critical crossing points.

LAS DEPARTURES.

A. Departure control will vector all IFR high-performance aircraft to the appropriate exit fix via the Las Vegas One Departure (see configuration 1 and figure C-20).

B. Departure control will, in addition, work all TCA and non-high-performance IFR aircraft, northeast through southeast.

C. Final West will work all TCA and non-high-performance IFR aircraft to the west and south.

D. Winterwood Departure

1. After takeoff, fly direct to Winterwood Golf course at or below 3,500 m.s.l., thence direct Vegas Wash Marina, climbing to 5,500 feet m.s.l. to depart the TCA.

E. Substation Departure

1. After takeoff, turn left, fly direct to the Charleston Substation to depart the TCA.

LSV DEPARTURES.

A. Casino Two Departure

1. Proceed via LAS 018 radial to 20 DME fix, thence via transition or assigned route.

B. Nellis Two Departure

1. Proceed via LSV 025 radial to Garbs int., thence via transition or assigned route. Cross LSV 025 radial 12 DME at or above 5,000 feet. Cross Garbs int. at or above 8,000 feet.

C. Sunrise One Departure

1. After takeoff, make immediate left climbing turn within 2 nmi of LSV via direct LAS, thence via LAS 066 radial to KIDS int. Cross KIDS int. at or above 5,000 feet, thence via transition or assigned route.

LSV STEREO DEPARTURE ROUTE.

A. Apex Departure

1. Depart via the LSV 029 radial and proceed to Apex, thence via appropriate transition. This departure will be restricted and tunneled beneath the Lee and Sally recoveries.

a. Gass transition--after Gass, left turn to heading 260°.

b. Sally transition--after Gass, left turn to heading 335° and proceed to Sally.

CONFIGURATION 4 LAS RWYS 25/19 LSV RWY 3 (FIGURE C-18).

LAS ARRIVALS. (Same as configuration 1)

LSV ARRIVALS. (Same as configuration 3)

LSV STEREO RECOVERY ROUTES. (Same as configuration 3)

LAS DEPARTURES. (Same as configuration 1)

LSV DEPARTURES. (Same as configuration 3)

LSV STEREO DEPARTURE ROUTE. (Same as configuration 3)

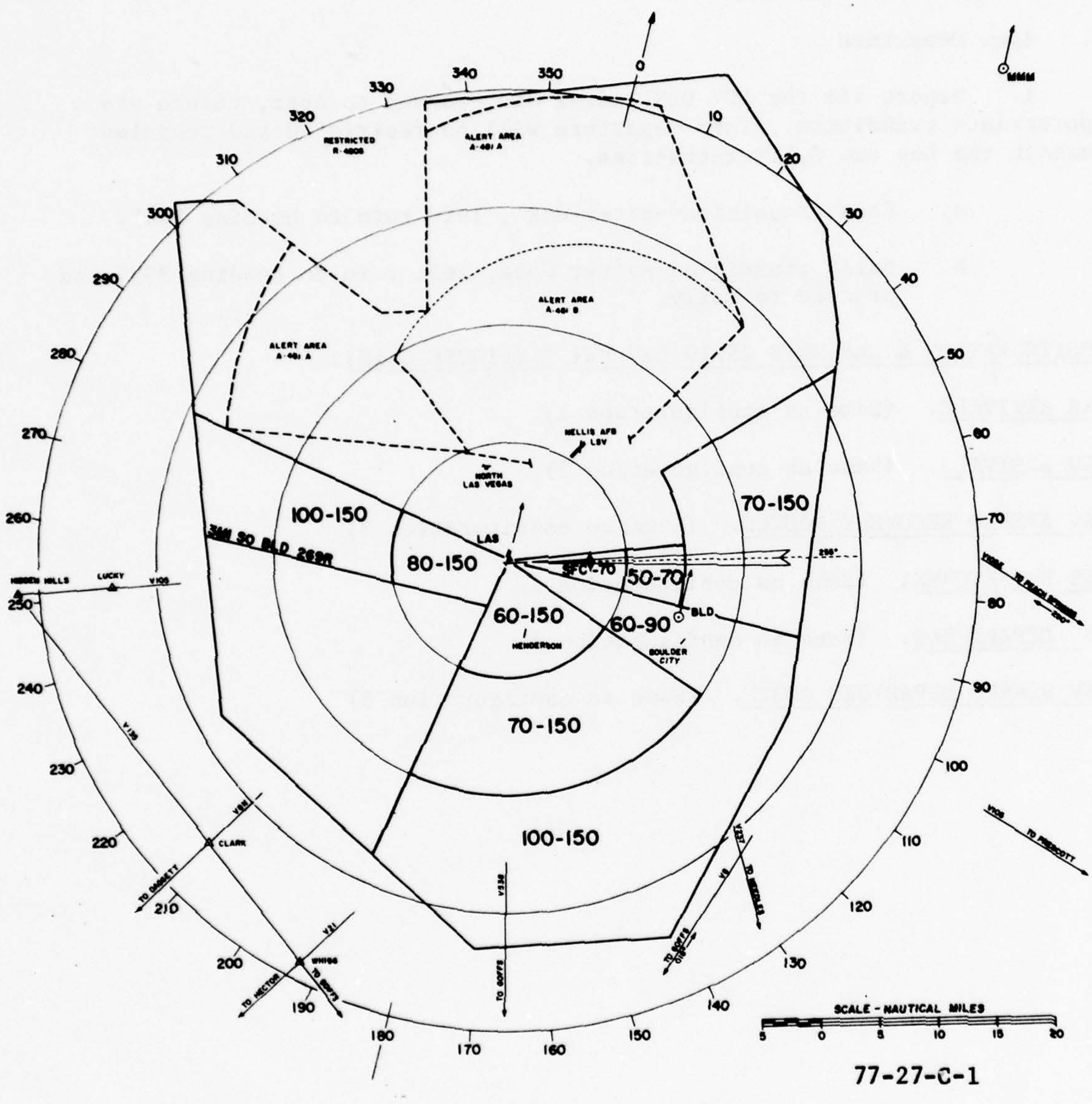


FIGURE C-1. SECTORIZATION CHART--ARRIVAL CONTROLLER--RUNWAY 25 AND 19

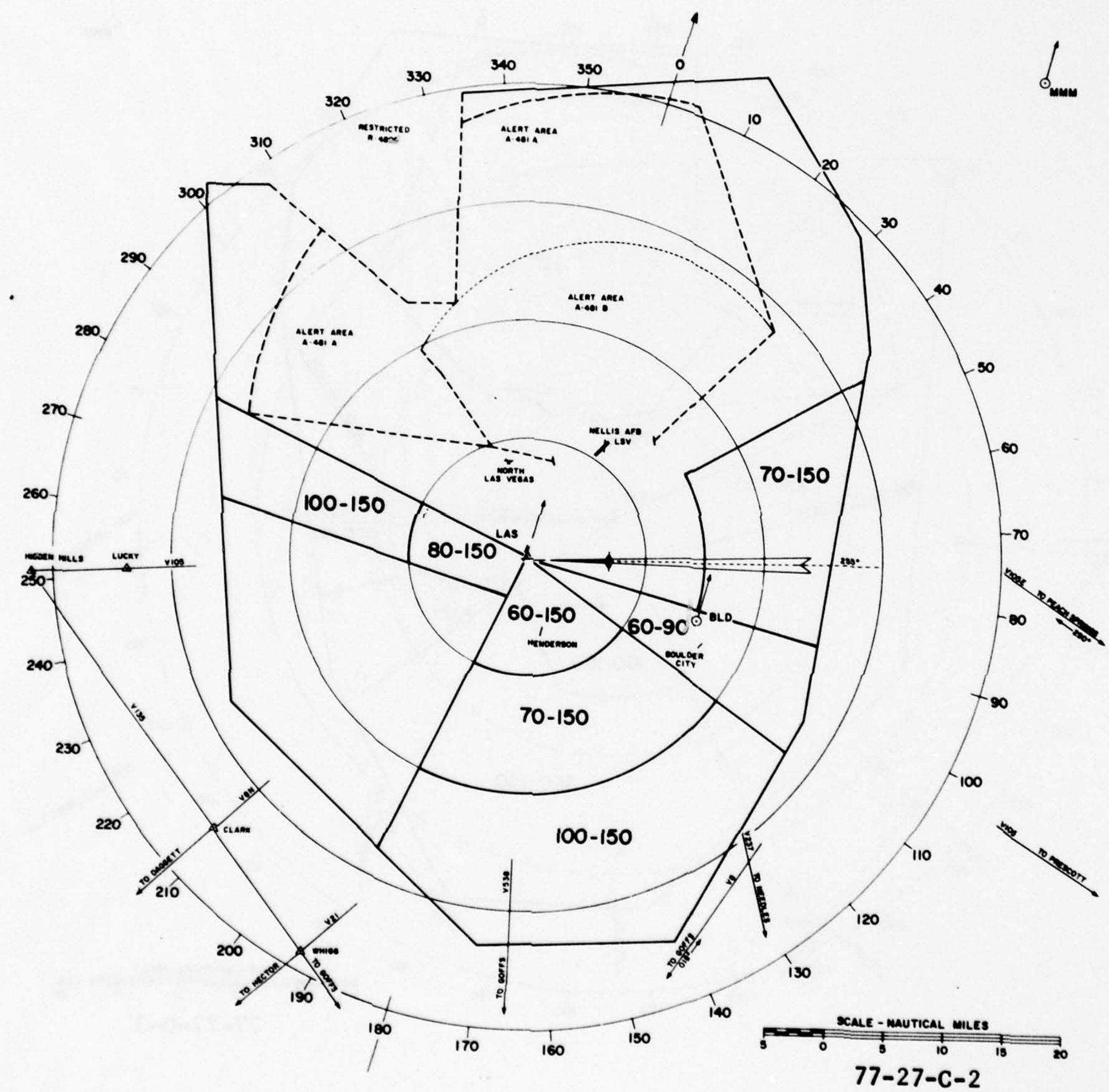


FIGURE C-2. SECTORIZATION CHART--ARRIVAL CONTROLLER--LAS RUNWAY 19R/19L

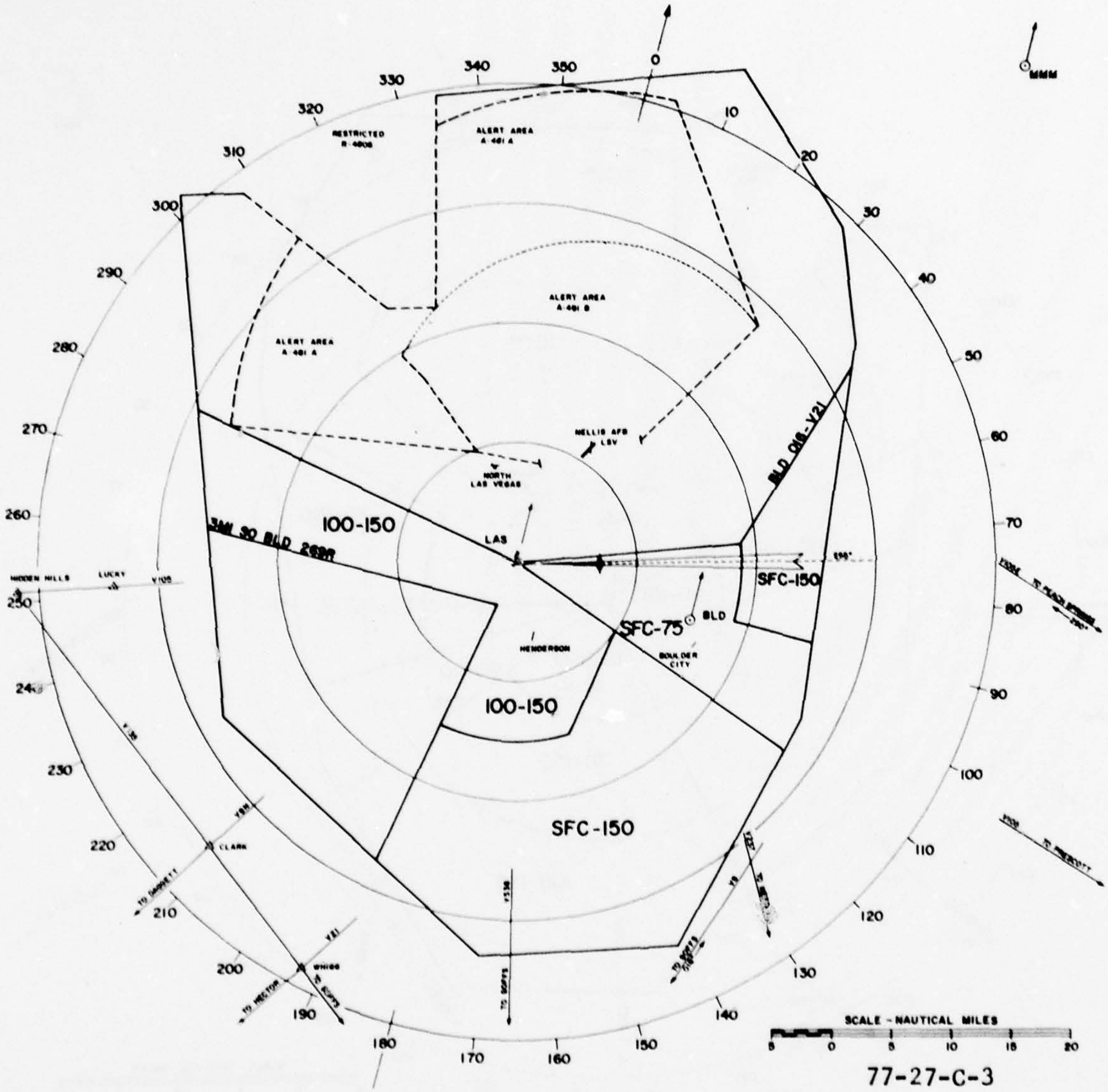


FIGURE C-3. SECTORIZATION CHART--ARRIVAL CONTROLLER--LAS RUNWAY 01R/01L

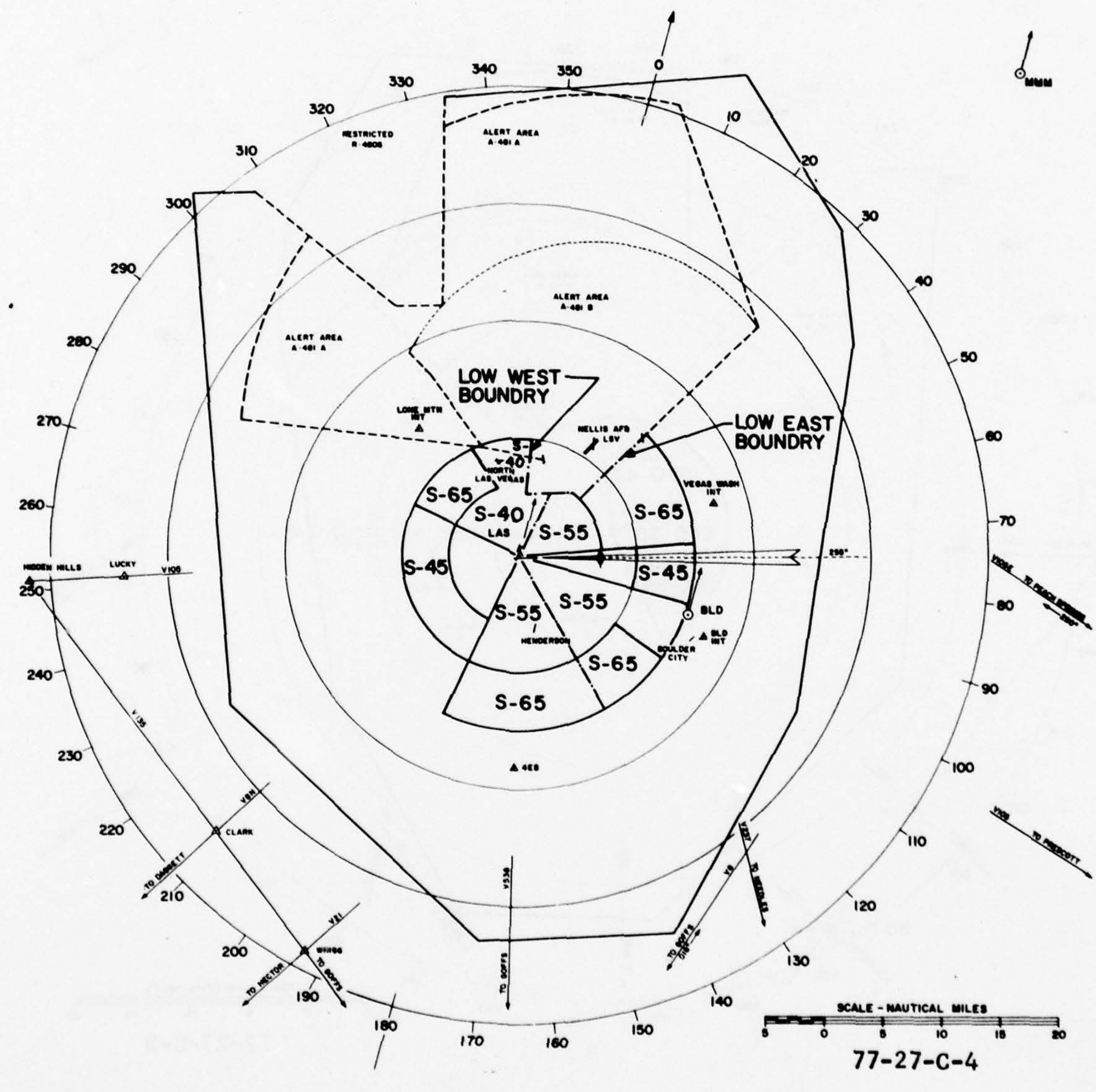


FIGURE C-4. SECTORIZATION CHART--LOW EAST AND LOW WEST--RUNWAY 25 AND 19

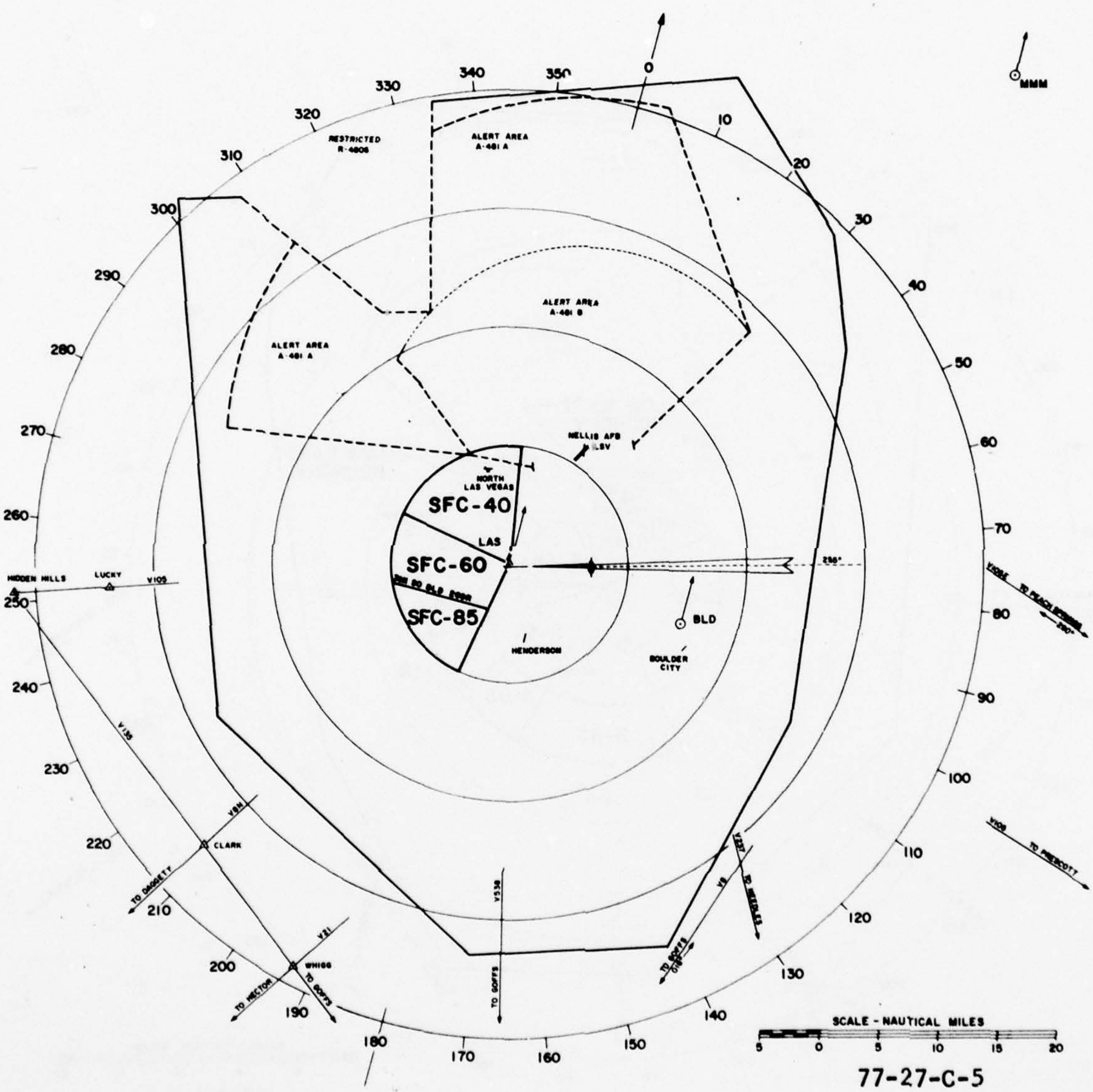


FIGURE C-5. SECTORIZATION CHART--LOW WEST AND TCA DEPARTURE--LAS RUNWAY 01R/01L

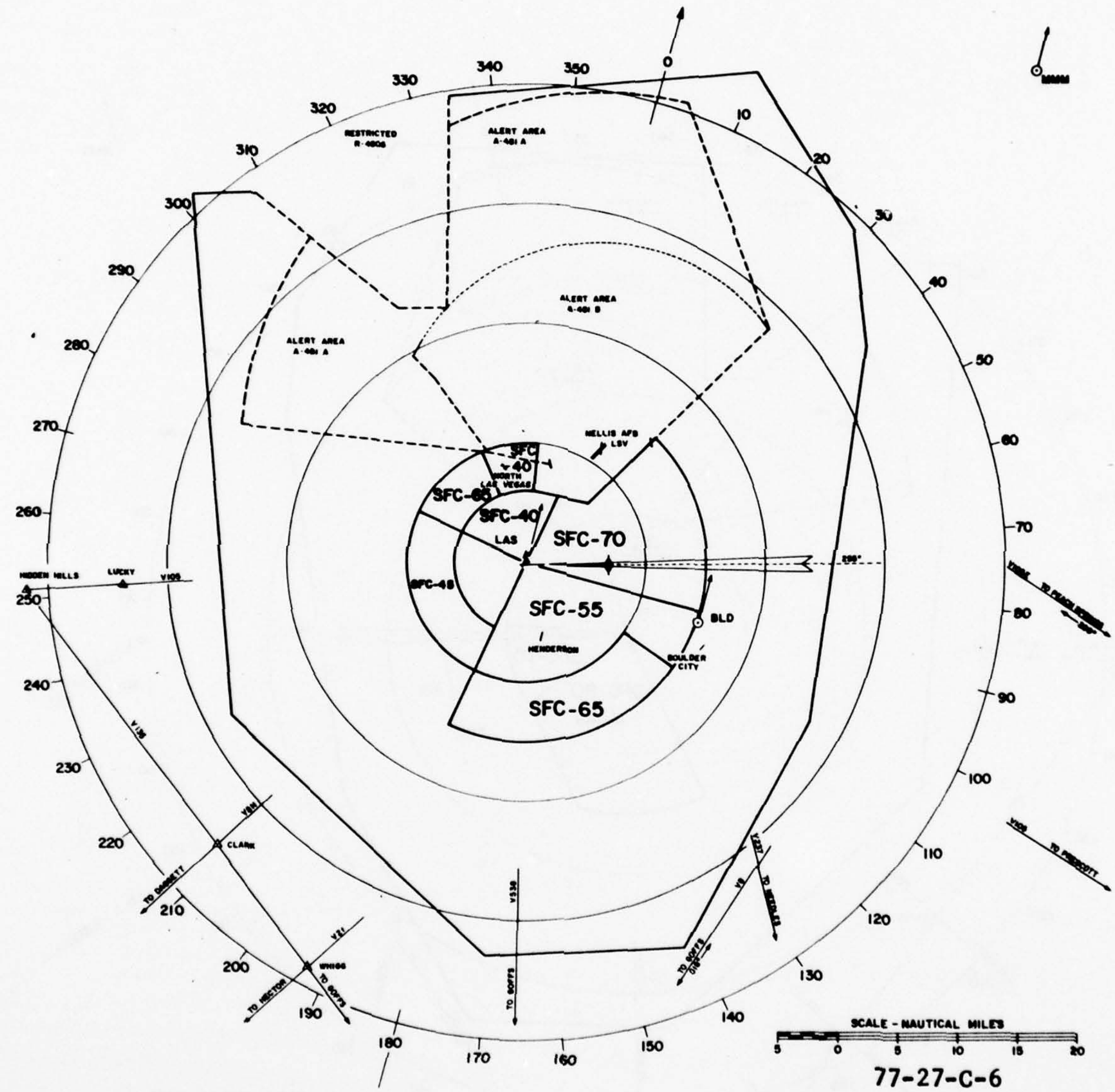


FIGURE C-6. SECTORIZATION CHART--FINAL/LOW EAST CONTROLLER AND LOW WEST--LAS RUNWAY 19L/19R

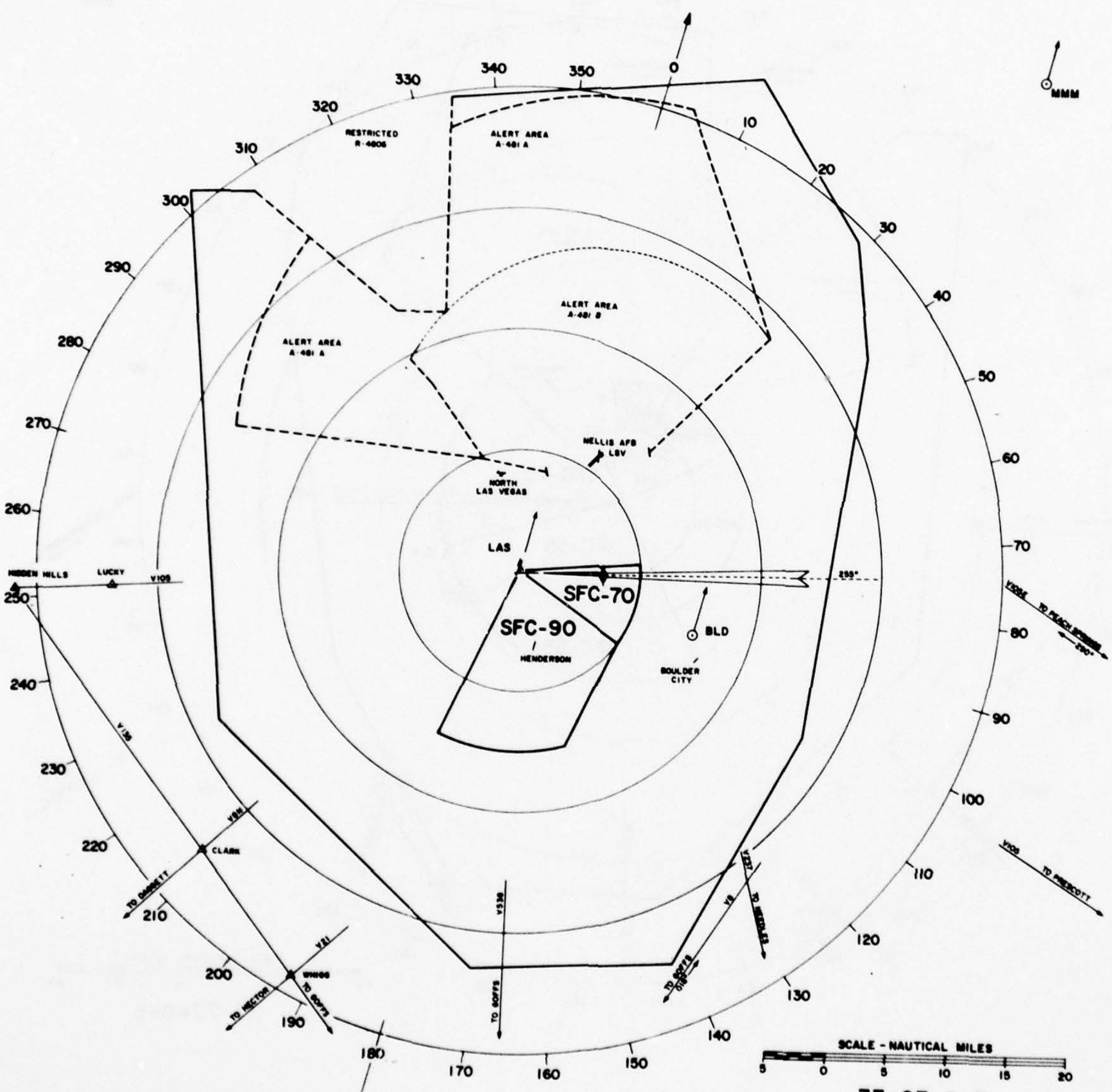


FIGURE C-7. SECTORIZATION CHART--FINAL/LOW WEST CONTROLLER--LAS RUNWAY 01R/01L

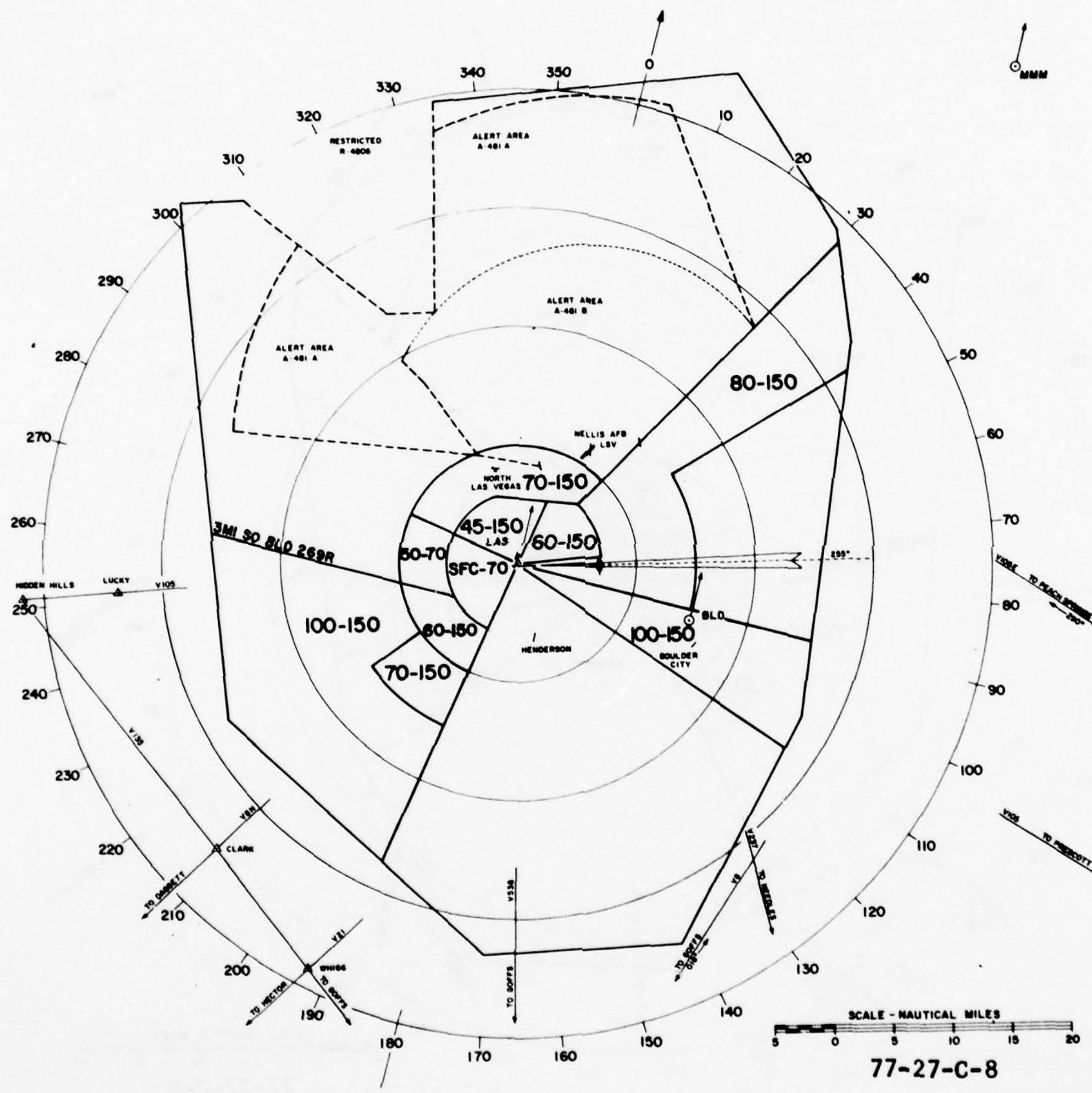


FIGURE C-8. SECTORIZATION CHART--DEPARTURE CONTROLLER--RUNWAY 25 AND 19

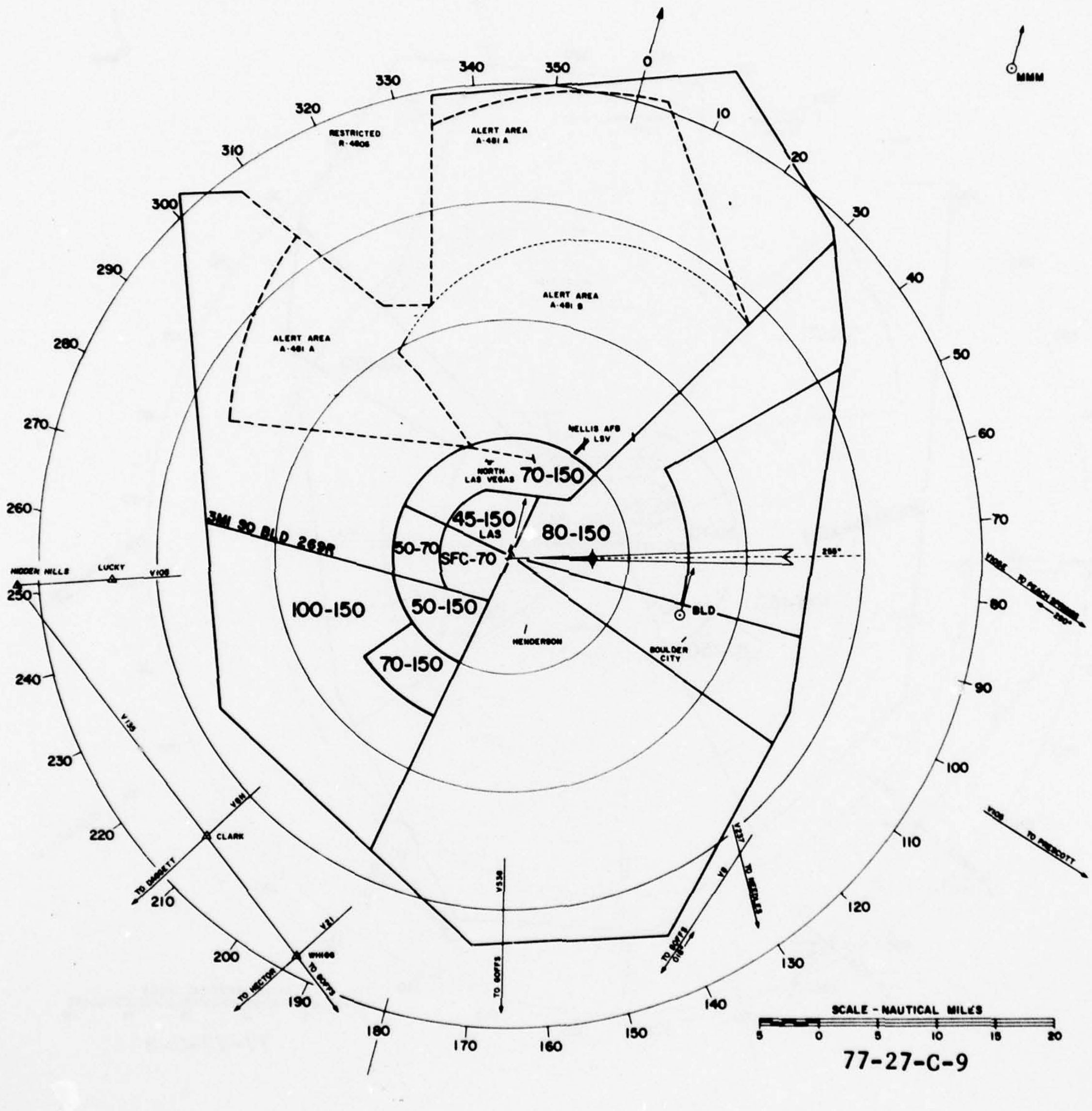


FIGURE C-9. SECTORIZATION CHART--DEPARTURE CONTROLLER--LAS RUNWAY 19R/19L

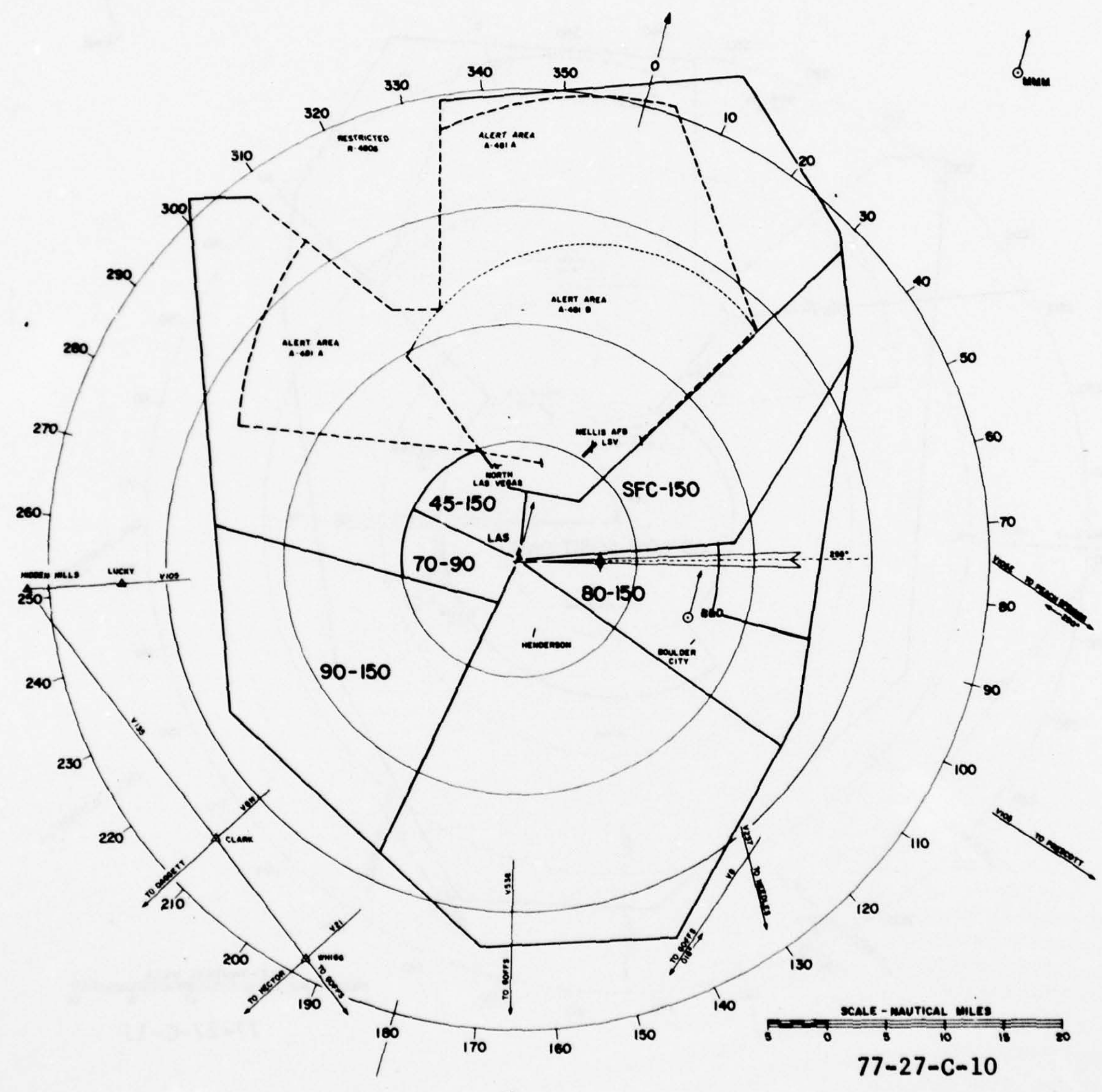


FIGURE C-10. SECTORIZATION CHART--DEPARTURE CONTROLLER--LAS RUNWAY 01R/01L

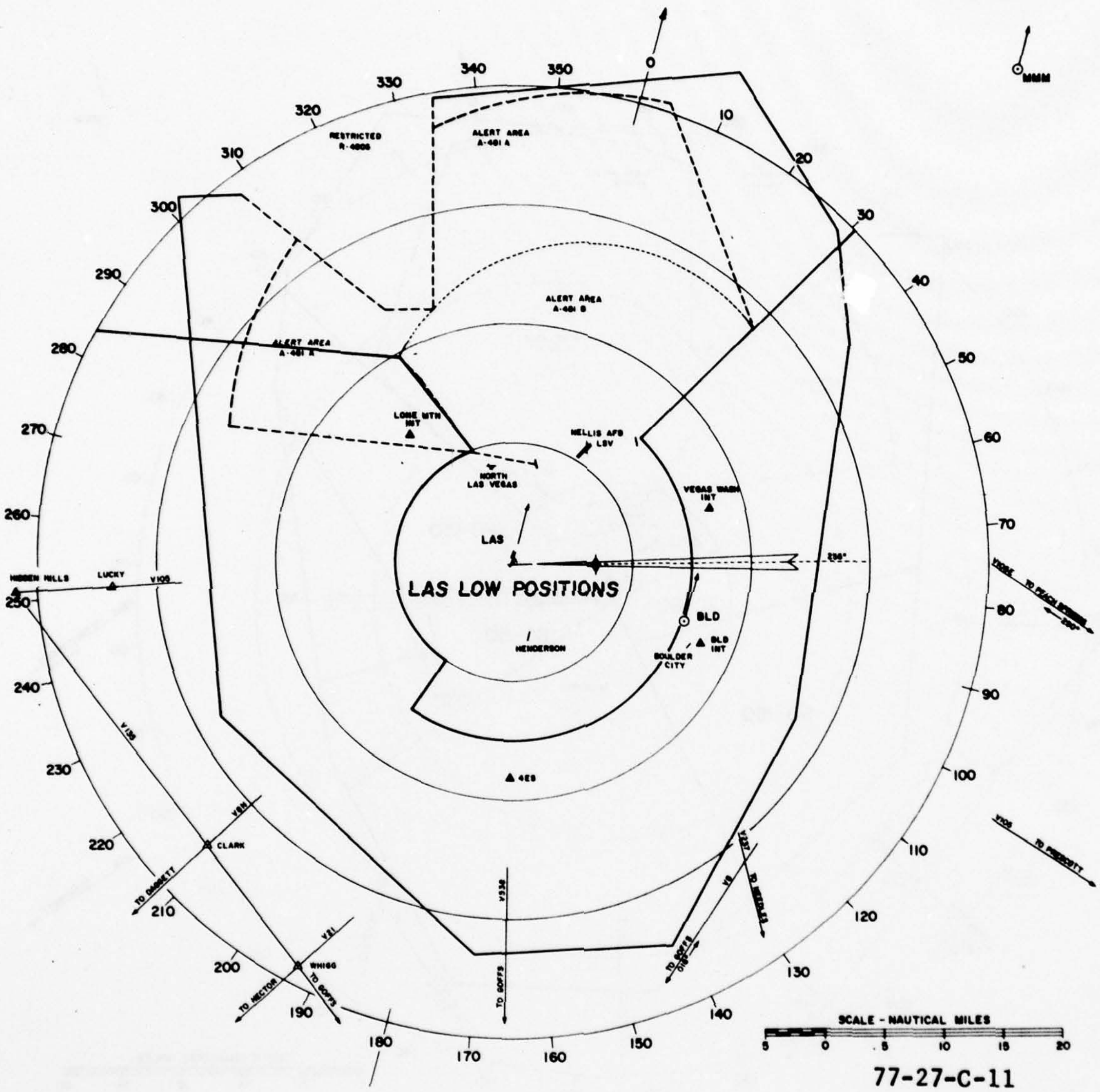


FIGURE C-11. SECTORIZATION CHART--EXPANDED RADAR SERVICE (ERS)--LAS RUNWAY 25 AND 19

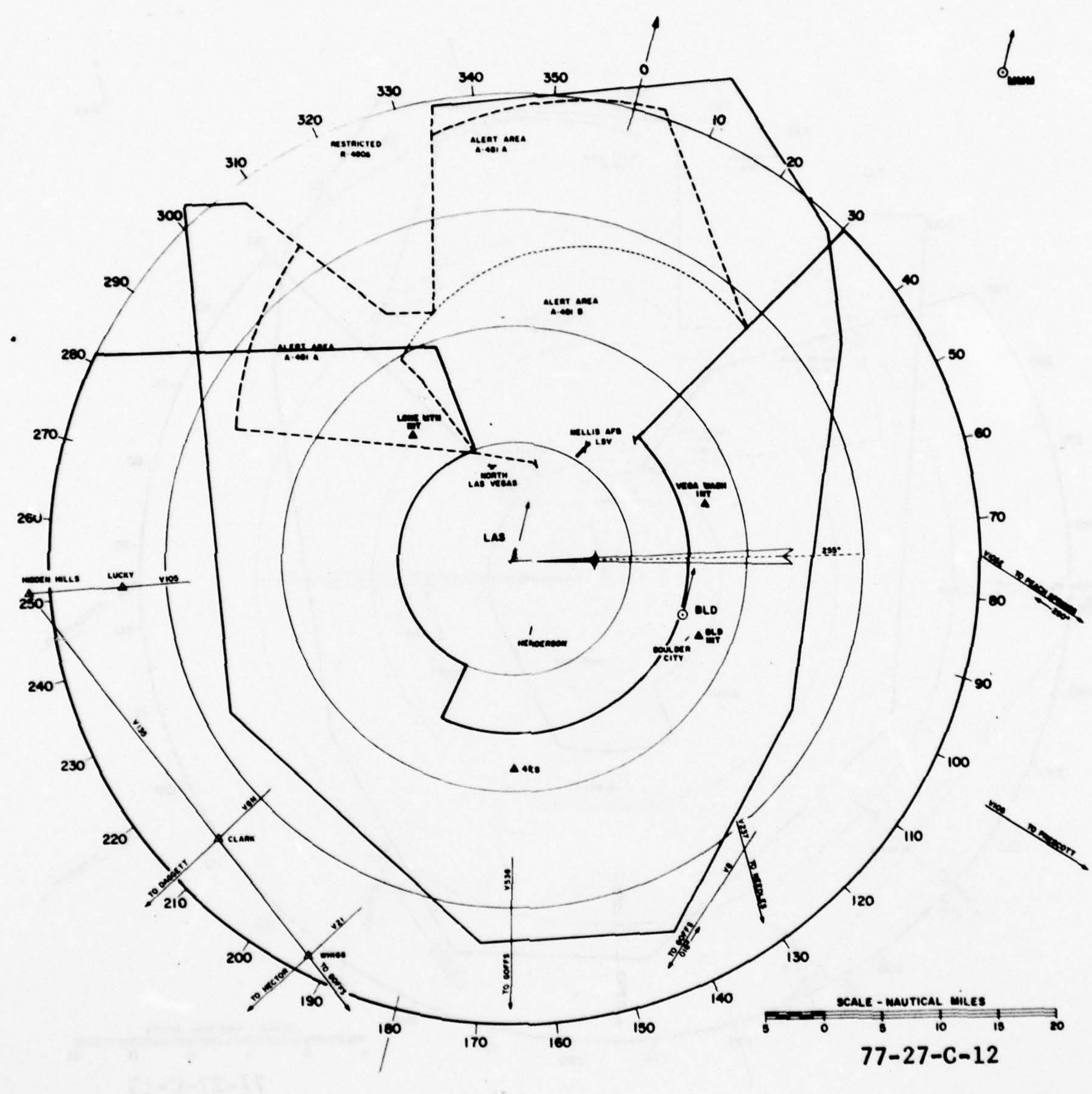


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FIGURE C-12. SECTORIZATION CHART--EXPANDED RADAR SERVICE (ERS)--LAS RUNWAY 19R/19L

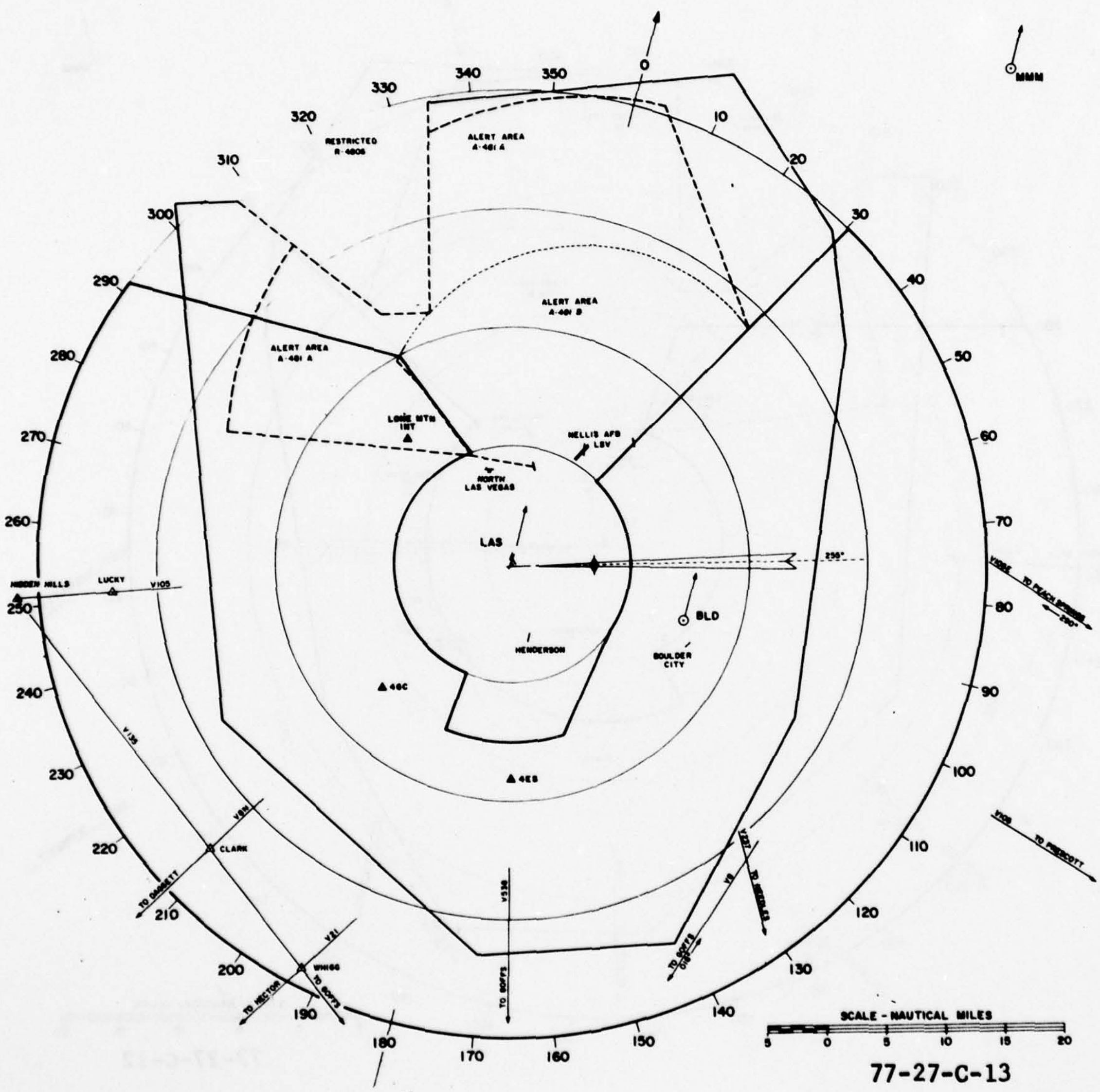

FIGURE C-13. SECTORIZATION CHART--EXPANDED RADAR SERVICE (ERS)--RUNWAY 01R/01L

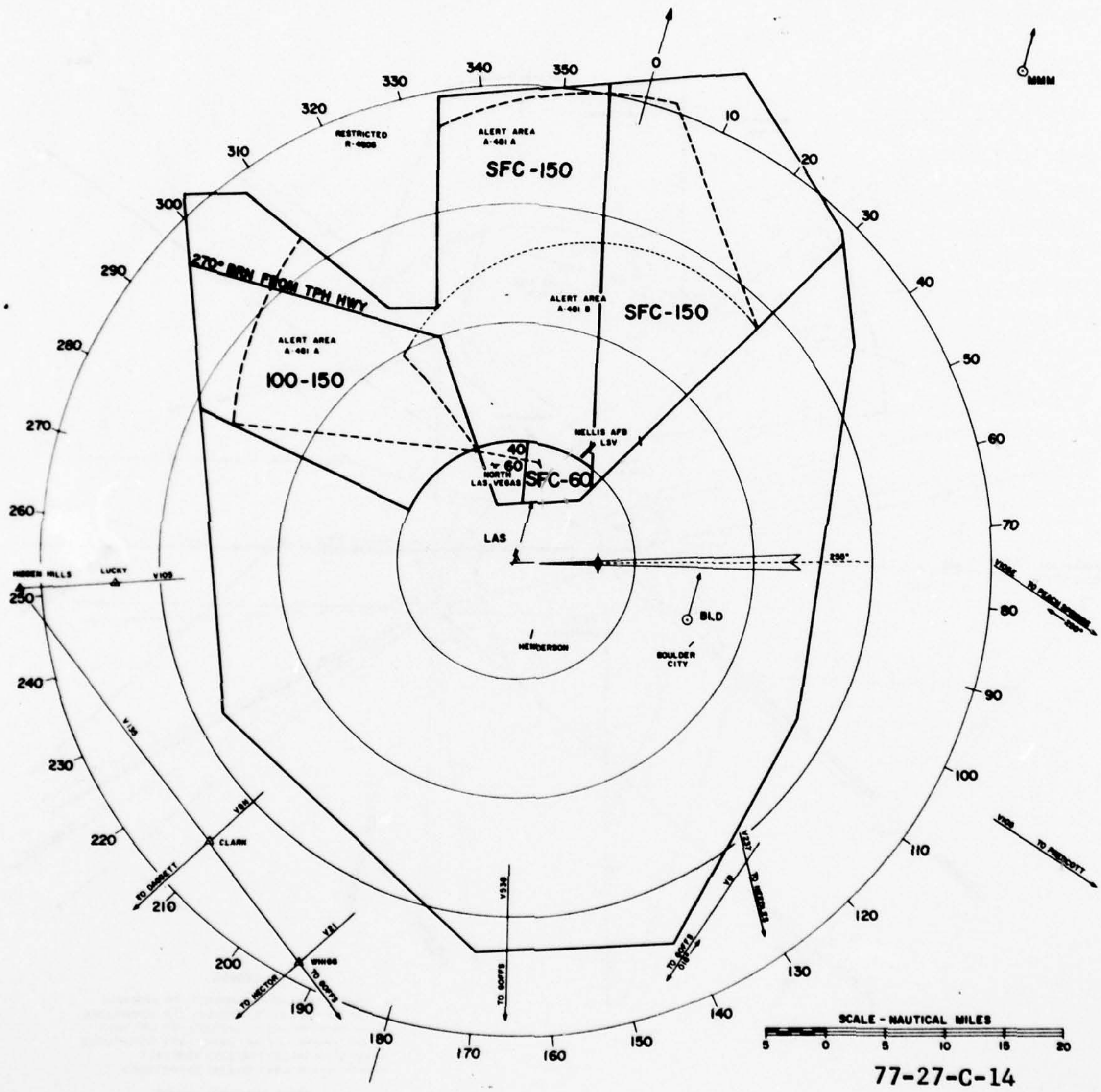

FIGURE C-14. SECTORIZATION CHART--NELLIS SECTOR CONTROLLERS

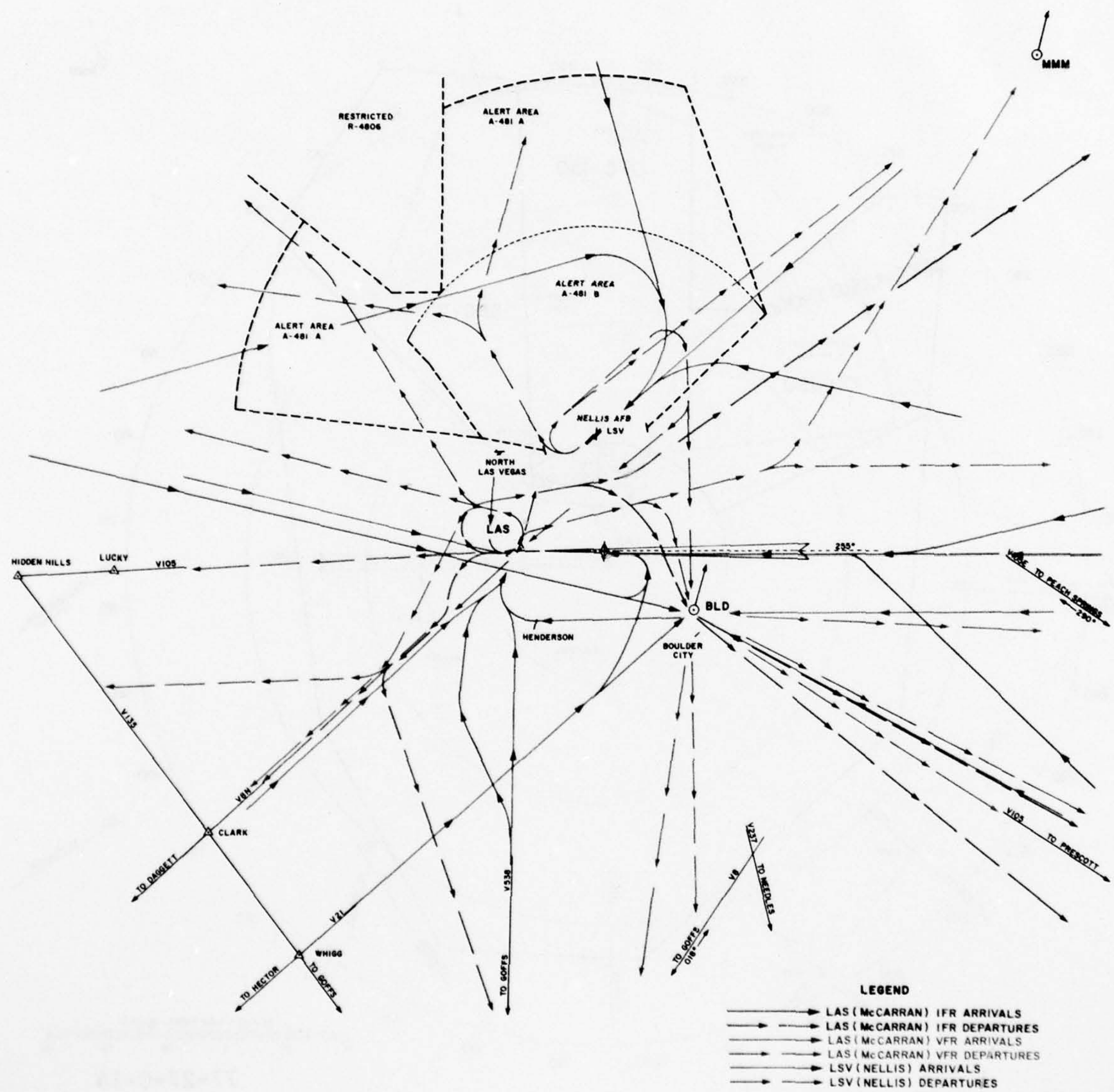

FIGURE C-15. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 21R/21L (CONFIGURATION 1)

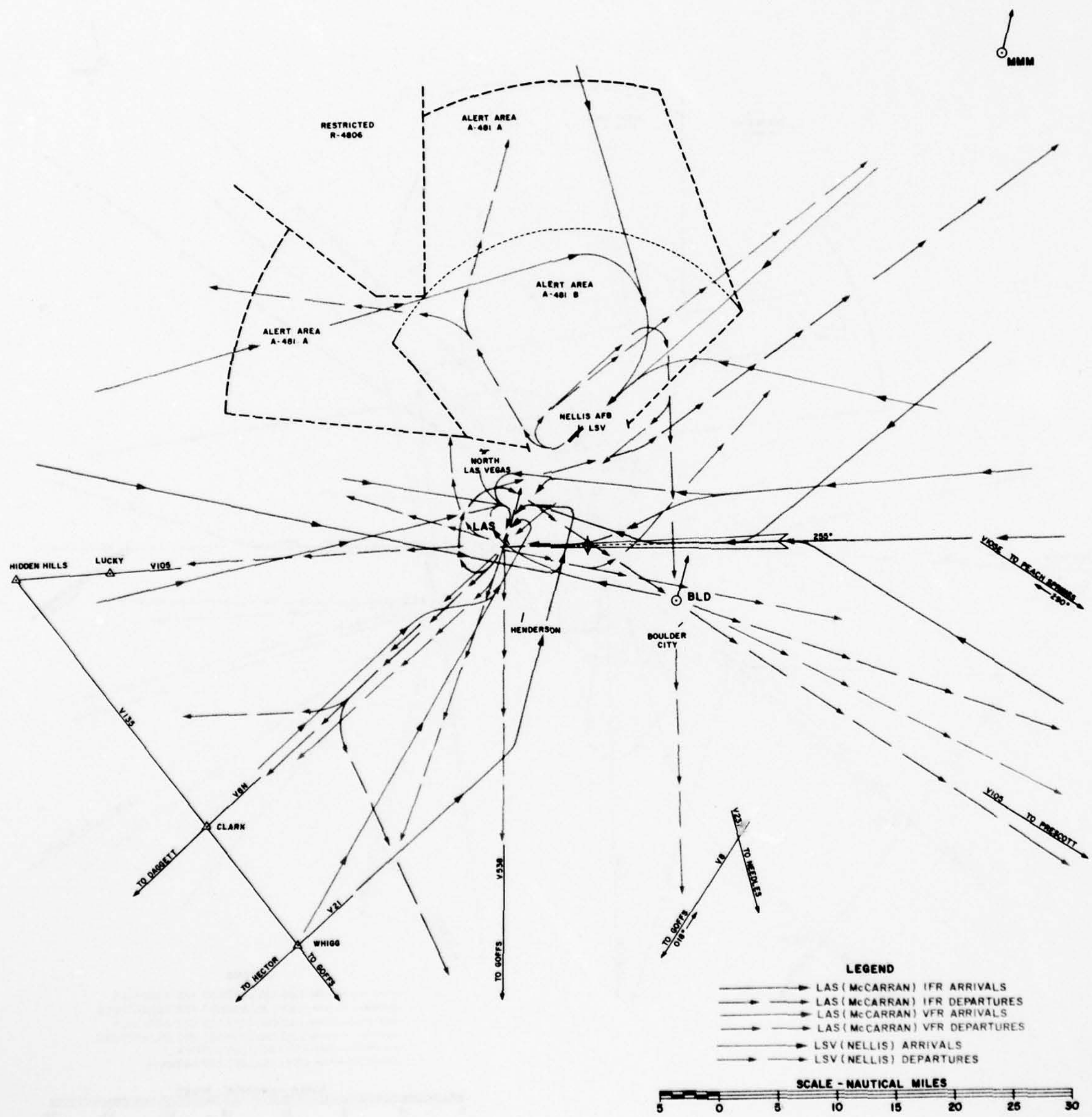

FIGURE C-16. FLOW CHART--LAS RUNWAYS 19R/19L, LSV RUNWAYS 21R/21L (CONFIGURATION 2)

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LAS VEGAS GRAPHIC STUDY.(U)
JAN 78 J J MAURER, V J MISIEWICZ, R W TACK
UNCLASSIFIED FAA-NA-77-27 FAA-RD-77-182 NL

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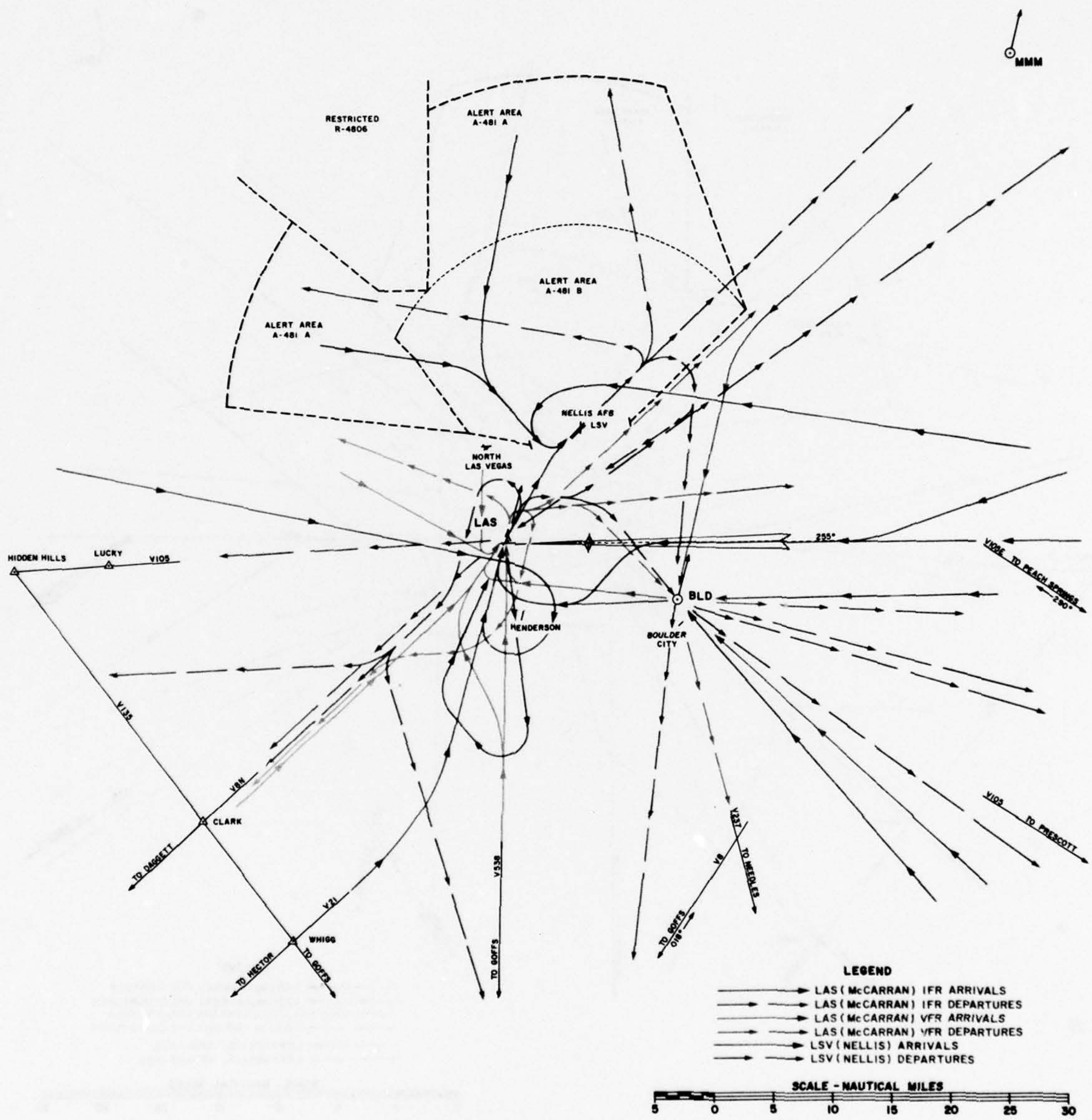


FIGURE C-17. FLOW CHART--LAS RUNWAYS 01R/01L, LSV RUNWAYS 03R/03L (CONFIGURATION 3)

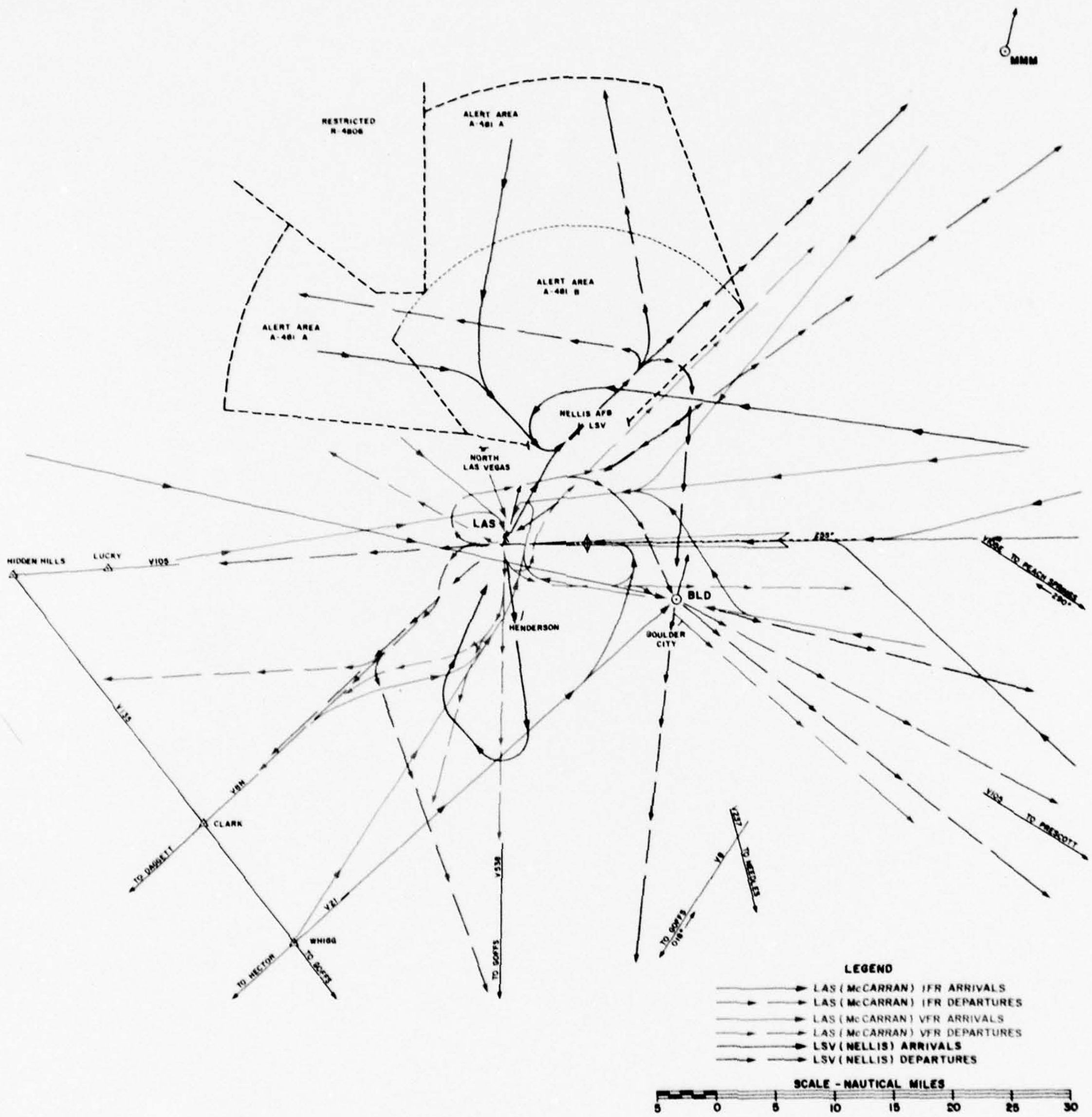


FIGURE C-18. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 03R/03L (CONFIGURATION 4)

APPENDIX D

LAS VEGAS TERMINAL AREA, PLAN 2 OPERATION

APPENDIX D

LIST OF ILLUSTRATIONS

LAS VEGAS TERMINAL AREA, PLAN 2 OPERATION

GENERAL.

POSITION DESCRIPTION.

A. Arrival Controller (figures D-1 and D-2)

1. Responsible for sequencing and vectoring IFR arrival traffic either to the final approach course for an instrument approach to the active runway or to the traffic pattern for a visual approach.

B. LAS Low East Controller (figures D-3 and D-4)

1. Responsible for sequencing VFR traffic inbound from the east to the runway(s) in use for category I and II aircraft in conjunction with the traffic sequenced by LAS West position. This position also controls VFR departures and IFR departures which initially enter its airspace and are not capable of flying the LAS SID's. This controller must separate traffic from Nellis flow and coordinate with other sectors, Local Control, and Nellis when needed.

C. LAS Low West Controller (figures D-3 and D-4)

1. Responsible for sequencing VFR traffic inbound from the west to the runway(s) in use for category I and II aircraft in conjunction with the traffic sequenced by LAS Low East position. This position also controls VFR departures and IFR departures which initially enter its airspace and are not capable of flying the LAS SID's. This controller must separate traffic from Nellis flow and also issue IFR clearances and discrete VFR codes to North Las Vegas Tower upon request. He coordinates with other sectors, Local Control, and Nellis where needed.

D. Radar Departure Controller (figures D-5 and D-6)

1. Responsible for controlling IFR departures and pure jet VFR departures in assigned airspace as described according to runway in use. This controller must insure that appropriate heavy jet separation is maintained between aircraft under his control and VFR TCA aircraft. Nonjet IFR traffic is often integrated with the TCA traffic flow by the TCA sectors, and a handoff is made to the departure sector after coordination.

E. LSV East Controller (figure D-7)

1. Responsible for controlling and sequencing all high-altitude penetrations and low-altitude arrivals and departures entering his delegated airspace for Nellis AFB. This controller must coordinate with Nellis AFB and any other affected intrafacility sectors as needed. Issues clearances to Nellis AFB when runway 03 is in use.

F. LSV West Controller (figure D-7)

1. Responsible for the arrival runway sequence for Nellis AFB and departures off Nellis entering his delegated airspace. Issues clearances to Nellis AFB when runway 21 is in use. Must coordinate with Nellis AFB and any other affected intrafacility sectors as needed. Note: The Nellis East and Nellis West positions are located side by side in the TRACON and use the same radar display. Close coordination is required between the two positions and at times the positions are combined, traffic permitting.

<u>CONFIGURATION 1 LAS RWYS 25/19 LSV RWYS 21R/21L (FIGURE D-8)</u>.

<u>LAS ARRIVALS</u>.

A. Three STAR's will funnel IFR jet traffic to the airport. Traffic inbound from the west and south flows toward the Boulder City VORTAC and is radar vectored prior to or upon reaching the VORTAC to runway 25. The west inbound flow is known as the Fuzzy 1 arrival, and the flow from the south is the Crescent 3 arrival. The remaining STAR is the Crowe One Arrival, which blends inbound traffic from the northeast, east, and southeast, generally blending traffic by means of radar vectors so the sequence is accomplished in the vicinity of the Boulder VORTAC and proceeds straight in for runway 25.

B. IFR nonjet traffic is routed over preferred arrival airways using altitude separation and usually sequenced to runways 19 with TCA nonjet traffic.

C. VFR arrivals from the south will be vectored to the east of the Freeway.

D. VFR arrivals from the east of BLD will be descended below 6,500 feet (below localizer) and vectored beyond 15 nmi east of LAS for left base to runway 19L. Aircraft inbound south of BLD will be vectored direct LAS VORTAC for downwind over the numbers of runway 25.

E. Existing ILS will be retained for runway 25R.

F. Air Taxi Routes

1. Winterwood Arrival

a. Depart Vegas Wash Marina at or below 5,500 m.s.l. descending direct Winterwood Golf Course. Cross Winterwood Golf course at or below 3,500 m.s.l. for base entry to runways 25 or 19.

2. Substation Arrival

a. Depart Charleston Substation at 4,000 m.s.l. heading 090° for entry to the traffic pattern for runways 25, 19, and 1.

LSV ARRIVALS.

A. An east/west airspace split between the two Nellis radar sectors located at the LAS TRACON will enable each sector to handle one of the two primary VFR arrival fixes, i.e., Sally and Lee. All high-altitude penetrations are controlled by the East and Nellis sector. Low-altitude arrivals are initially controlled by the sector which owns the airspace. Approximately 75 percent of the Nellis traffic uses stereotyped VFR arrival/departure procedures. Most of the arrivals are "pop up" traffic at Sally or Lee, with the Lee recovery worked by West, while East calls the sequence.

B. Most of the time the Nellis operation will be combined between the two positions, with one controller acting as a coordinator, while the other controller is working the actual recovery of inbound aircraft. The recovery aircraft is sequenced for GCA approaches (full stop on practice) or vectored to the final approach course before releasing the aircraft to either GCA or Nellis tower. When necessary to split the sector between east or west arrival, the east controller normally handles the practice approaches.

C. LSV arrival routes will include the following:

1. Addition of ILS to runway 21.

2. Change LSV TACAN to a VORTAC.

D. Arrivals will use ILS or VORTAC approaches depending on type of equipment.

1. Allows all aircraft to be cleared direct to LSV, reducing coordination between LAS and Los Angeles Center.

2. Procedures will be initiated for release of aircraft to the LSV GCA.

LSV STEREO RECOVERY ROUTES (FIGURES D-9 and D-10).

A. Sally Recovery

1. Depart Sally at 12,000 to 14,000 feet heading 155°. Cross White River at 12,000 to 14,000 feet. Cross the LSV 015 radial at or above 7,500 feet. Cross Apex at or above 4,500 feet. Turn right onto initial, descending to 3,500 feet.

B. Lee Recovery

1. Depart Lee direct to Apex, maintain 11,000 feet until abeam Flex Gunnery Range. Cross LSV 015 radial at or above 7,000 feet to cross Apex at or above 4,500 feet, turn right to initial, descending to 3,500 feet.

a. This procedure will allow arrivals to be placed above departures, providing altitude separation where routes cross.

LAS DEPARTURES.

A. All IFR jet departures will climb to 15,000 feet and will be radar vectored to the SID's. This accomplishes noise abatment and initial altitude separation from TCA traffic as well as a reduction in clearance delivery phraseology and lost communication procedures.

1. Oveto Two Departure

a. Climb runway heading for vector to LAS 039 radial to Oveto DME fix, thence via transition or assigned route.

2. Mead Three Departure

a. Climb runway heading for vectors to Boulder City VORTAC, thence via transition or assigned route.

3. Goodsprings Three Departure (Figure D-11).

a. Climb via runway heading for vectors to Goodsprings VHF/DME fix, thence via transition or assigned route.

B. There is one LAS IFR departure sector; however, nonjet IFR traffic will often be integrated with the TCA traffic flow by the TCA sectors, and a handoff made to the departure sector, after coordination.

C. TCA North departures will be vectored to exit the TCA via the relocated V8N (figure D-12).

D. TCA South departures will proceed via runway heading, which alters course approximately 3 nmi and insures lateral separation from IFR departures and VFR arrivals from the south.

E. Air Taxi Routes

1. Canyon Departure

a. After takeoff, fly heading 100° to the Henderson Cutoff (State Highway 40) at or below 3,000 m.s.l., thence proceed direct to BLD VORTAC, climbing to 5,500 m.s.l. to depart TCA.

2. Substation Departure

a. After takeoff, turn right, fly direct to Charleston Substation climbing to 3,500 m.s.l. to depart TCA.

LSV DEPARTURES.

A. Casino Departure (Figure D-13).

1. After takeoff, turn right and proceed direct to LSV 010/10 DME fix, then if proceeding:

a. Northeast, fly direct to the LSV 030/60 DME fix for transition or assigned route.

b. East, south, or west, right turn back to the LSV VORTAC via the LSV 029 radial, thence direct LAS VORTAC or BLD VORTAC to transition or assigned route. This procedure allows for higher altitude and less confliction with LAS traffic.

B. Sunrise One Departure

1. Depart LSV direct to LAS VORTAC, direct to BLD VORTAC, thence via transition or assigned route.

a. Positions aircraft on same track as other aircraft with like characteristics.

C. Nellis Two Departure

1. Maintain runway heading until 4 DME. Turn right, heading 050° to intercept, and proceed outbound via LSV 025 radial to Garbs intersection, thence direct to BCE for transition or assigned route. Cross LSV 253 radial at or below 6,000 feet, cross LSV 025/12 DME at or above 5,000 feet. Cross Garbs intersection at or above 8,000 feet.

a. Transitions to LAS and BLD VORTAC's are eliminated. These are included in Casino Departure above.

<u>LSV STEREO DEPARTURE ROUTE (FIGURE D-9)</u>.

A. Kraig Three Departure

1. After departure, turn right within 1.5 nmi, thence direct to Kraig. Cross Kraig between 4,000 feet and 6,000 feet with a right, climbing turn to a heading of 265° to cross Gass at or below 10,000 feet.

a. Gass transition - after Gass, turn left, heading 265°, to cross highway 95 at or below 10,000 feet.

b. Sally transition - after Gass, turn right, heading 010°, to cross Peggy at or below 11,000 feet or at 15,000 feet. Continue on 010° to Sally to cross Sally at or below 11,000 feet or at or above 15,000 feet.

<u>CONFIGURATION 2 LAS RNWY 19R/19L LSV RNWY 21R/21L (FIGURE D-14)</u>.

<u>LAS ARRIVALS</u>.

A. This runway configuration will use the same STAR's to position IFR jet traffic in the vicinity of the Boulder VORTAC as configuration 1. From this

point, radar vectoring is used to sequence traffic to runway 19L for a visual approach. IFR nonjet traffic is handled similarly to the runway 25 configuration.

B. TCA traffic will be routed parallel to IFR traffic or altitude separation will be used. When coordinated with the IFR arrival sector, this TCA traffic may be sequenced with the jet traffic to runway 19L. During moderate-to-heavy traffic conditions, such coordination is not usually feasible, and the TCA traffic is routed across the airport at midfield to enter a right downwind for runway 19R.

C. Air Taxi Routes

1. Winterwood Arrival (See configuration 1)

2. Substation Arrival (See configuration 1)

LSV ARRIVALS. (Same as configuration 1)

LSV STEREO RECOVERY ROUTES. (Same as configuration 1)

LAS DEPARTURES.

A. IFR and TCA departures will be much the same as configuration 1 except that jet aircraft share runway 19L with general aviation aircraft, which slows the operation to some extent, due to TCA departures turning across the jet departure course and having to meet the wake turbulence criteria.

B. Air Taxi Routes

1. Canyon Departure (Same as configuration 1)

2. Substation Departure (Same as configuration 1)

LSV DEPARTURES. (Same as configuration 1)

LSV STEREO DEPARTURE ROUTE. (Same as configuration 1)

CONFIGURATION III LAS RNWY 1R/1L LSV RNWY 3R/3L (Figure D-15).

LAS ARRIVALS.

A. IFR Jet arrivals will be vectored off the STAR routes to a visual approach for runway 1R. Arrivals from the west may be routed over the airport and vectored to a right downwind. Likewise, the arrivals from the south may continue the STAR until reaching the vicinity of Boulder VORTAC before being vectored into the arrival sequence. Due to the lowered TCA around Sky Harbor Airport, an easier base leg will be realized.

B. TCA traffic will be routed parallel to IFR traffic, and altitude separation is used more frequently. Visual separation is the rule of thumb once traffic

is established on final. TCA traffic may be sequenced with the jet traffic to runway 1R if the IFR sector is not working moderate or heavy traffic. When coordination is not feasible, the TCA traffic may be routed across the airport at midfield to enter a left downwind for runway 1L or a crossover accomplished southeast of the airport using altitude separation for a base leg entry to runway 1L.

C. VFR arrivals from the south will proceed via V8N or be vectored clear of final approach to 1R and positioned for close left base to 1L.

D. That portion of the relocated V8N airway located (figure D-12) northeast of LAS will result in a safer movement of LAS traffic relative to LSV operations.

E. Some of the vertical and lateral TCA boundaries will be modified to allow a less complex TCA.

F. Air Taxi Routes

1. Canyon Arrival

a. Depart BLD VORTAC at or below 5,500 m.s.l. descending direct Henderson. Cross Henderson at or below 3,500 m.s.l. for downwind or base leg entry to runway 1.

2. Substation Arrival (Same as configuration 1)

LSV ARRIVALS.

A. This runway configuration is a "flip-flop" operation from runway 21 (see configuration 1) where the controllers simply change positions. The West sector becomes arrival, and East becomes departure. This is accomplished easily, as the frequencies are available at both positions. The operation is essentially the same for both runway 21 and 3, with the only significant difference being the roles of arrival and departure--they alternate with the change of runways.

B. These arrivals will use instrument approaches derived from LAS NAVAID's.

1. Approaches positioned over LAS will allow continuous flow and less chance of conflictions.

2. Coordination will be required with the LAS arrivals for proper sequence.

LAS STEREO RECOVERY ROUTES (Figures D-9 and D-10).

A. Lee Recovery

1. Depart Lee heading 080° to Tule Springs. Cross Tule Springs at or above 6,500 feet. Turn right to 110°, cross Kraig at or above 4,500 feet and L.V. Blvd. at or above 4,000 feet. Turn left to initial descending to 3,500 feet.

B. Depart Sally at 12,000 to 14,000 feet heading 155°, cross White River at 12,000 to 14,000 feet, cross the LSV 015 radial at or above 7,500, cross intersection of highway 93 and south end of Hidden Valley at 8,000 feet; thence direct to Tule Springs to cross Gass at 8,000 feet. Cross Tule Springs at or above 6,500 feet, turn left to heading 100°, cross Kraig at or above 4,500 feet, cross Las Vegas Blvd. at or above 4,000 feet. Turn left to initial descending to 3,500 feet.

a. In moving the recovery route to the east, better radar coverage results.

LAS DEPARTURES.

A. IFR jet departure flows are much the same as the runway 25 (configuration 1) procedures. These departures will be altitude separated from the arrival traffic because of the slow rate of climb during the summer months. Nonjet IFR will normally be integrated with the TCA traffic flow.

B. TCA departures will be tunneled below the IFR departures in all directions. The TCA departure flow is considerably slower on this configuration due to the displaced thresholds and the separation criteria which must be applied. The jet and larger general aviation traffic share runway 01R requiring additional spacing to accomplish the departure crossover and having to meet the wake turbulence criteria (see TCA AR/DR routes attached).

C. Air Taxi Routes

1. Winterwood Departure

a. After takeoff, fly direct to Winterwood Golf Course at or below 3,500 m.s.l., thence direct Vegas Wash Marina, climbing to 5,500 m.s.l. to depart the TCA.

2. Substation Departure

a. After takeoff, turn left, fly direct to the Charleston Substation to depart the TCA.

LSV DEPARTURES.

A. Casino Departure (Figure D-13)

1. Depart on the LSV 010 radial to the LSV 010/10 DME fix, then if proceeding:

a. Northeast, fly direct to the LSV 030/60 DME fix for transition or assigned route.

b. East, south, or west, right turn back to the LSV VORTAC via the LSV 029 radial, thence direct LAS VORTAC or BLD VORTAC to transition or assigned route.

(1) Allows for higher altitude and less confliction with LAS traffic.

B. Sunrise One Departure

1. After takeoff, left climbing turn within 2 nmi of LSV via direct to LAS Vortac, to BLD VORTAC, thence via transition or assigned route.

a. Positions aircraft on same track as other aircraft with like characteristics.

C. Nellis Two Departure

1. After takeoff, proceed via LSV 025 radial to Garbs intersection, thence direct to BCE for transition or assigned route. Cross LSV 025/12 DME at or above 5,000 feet to cross Carbs intersection at or above 8,000 feet.

a. Transitions to LAS and BLD VORTAC's are eliminated. These included in Casino Departure above.

LSV STEREO DEPARTURE ROUTE (Figures D-9 and D-10).

A. Apex Departure

1. Depart direct to Dry Lake (LSV 013R - 16 nmi) to cross Dry Lake at or above 9,000 feet, then transition to Gass via a left turn direct or to ROX via a left turn direct.

a. This departure procedure will place arrivals below departures; otherwise, a too rapid descent to maintain altitude separation would result.

CONFIGURATION 4, LAS RNWYS 25/19 LSV RUNWAY 3 (Figure D-16).

LAS ARRIVALS. (Same as configuration 1)

LSV ARRIVALS. (Same as configuration 3)

LSV STEREO RECOVERY ROUTES. (Same as configuration 3)

LAS DEPARTURES. (Same as configuration 1)

LSV DEPARTURES. (Same as configuration 1)

LSV STEREO DEPARTURE ROUTES. (Same as configuration 3)

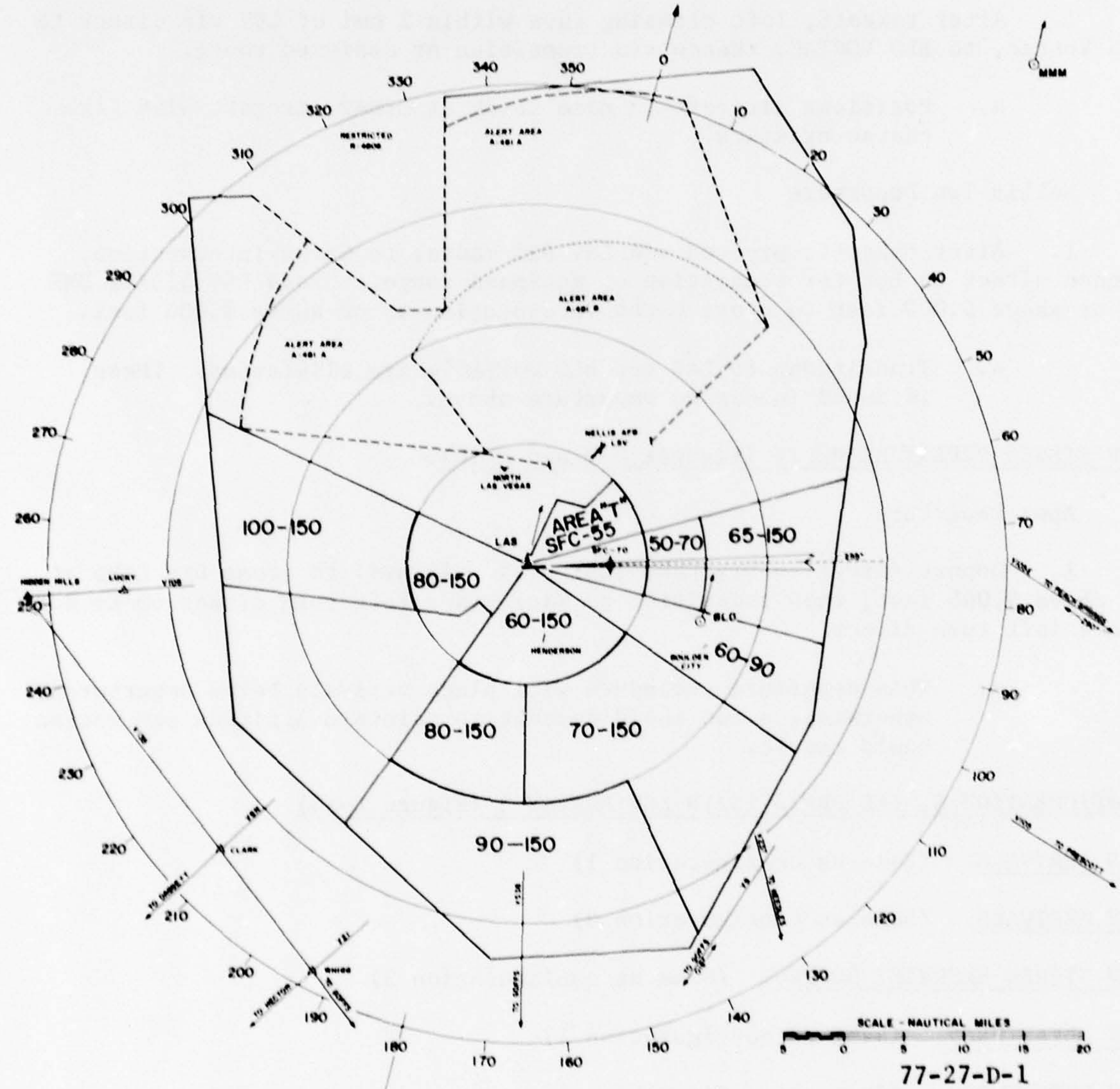


FIGURE D-1. SECTORIZATION CHART--ARRIVAL CONTROLLER--RUNWAY 25 AND 19

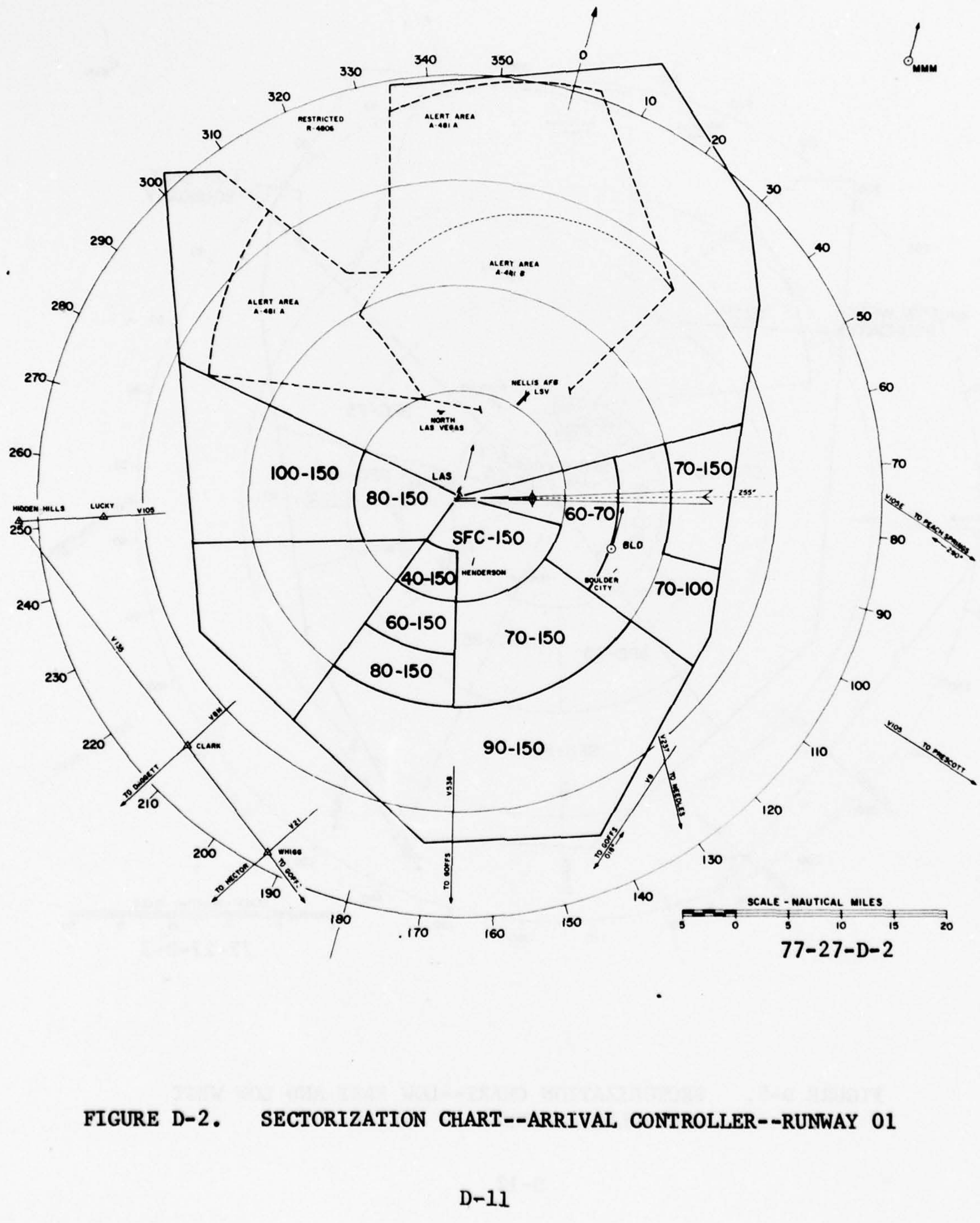


FIGURE D-2. SECTORIZATION CHART--ARRIVAL CONTROLLER--RUNWAY 01

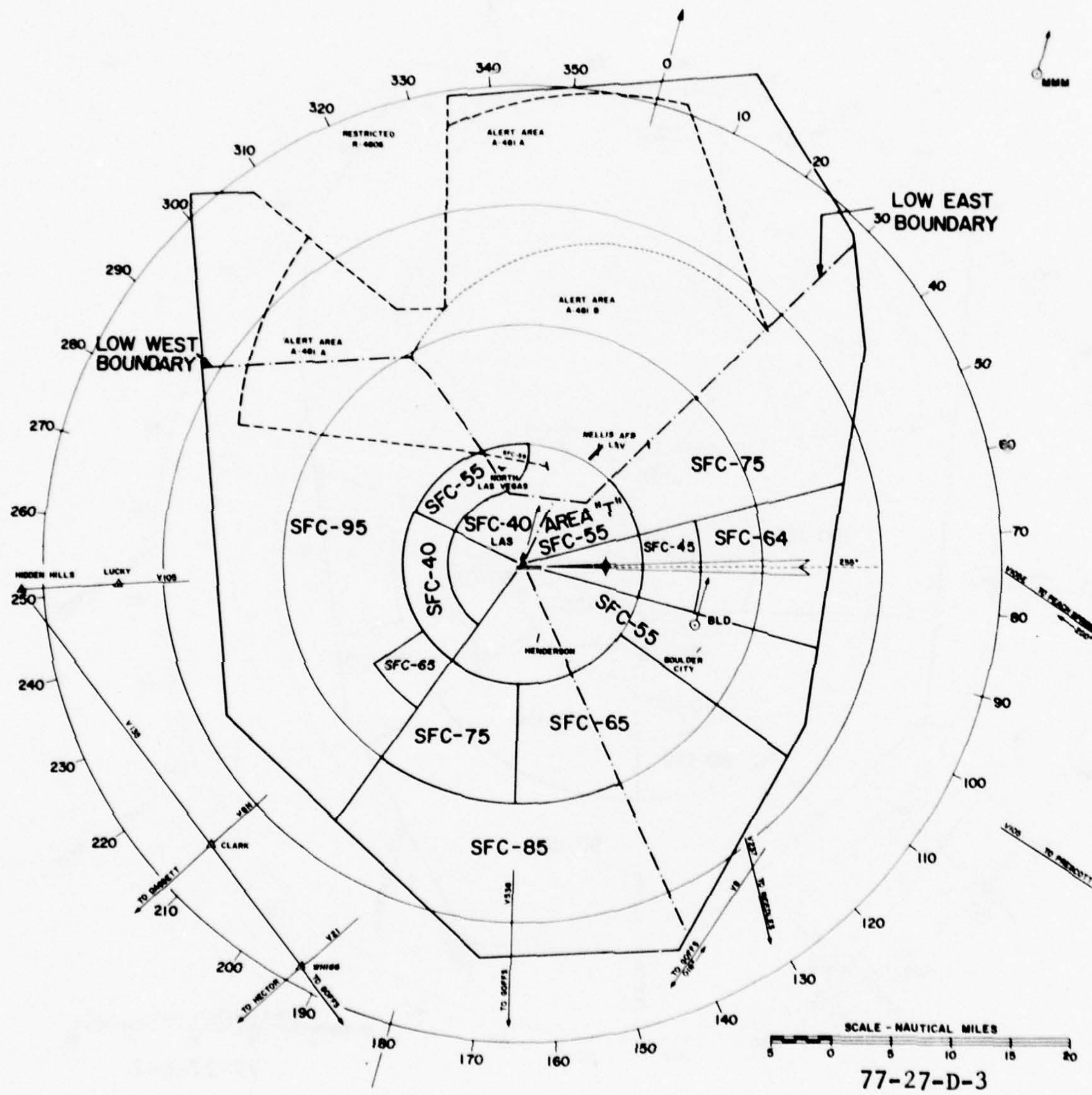


FIGURE D-3. SECTORIZATION CHART--LOW EAST AND LOW WEST CONTROLLER--RUNWAY 25 AND 19

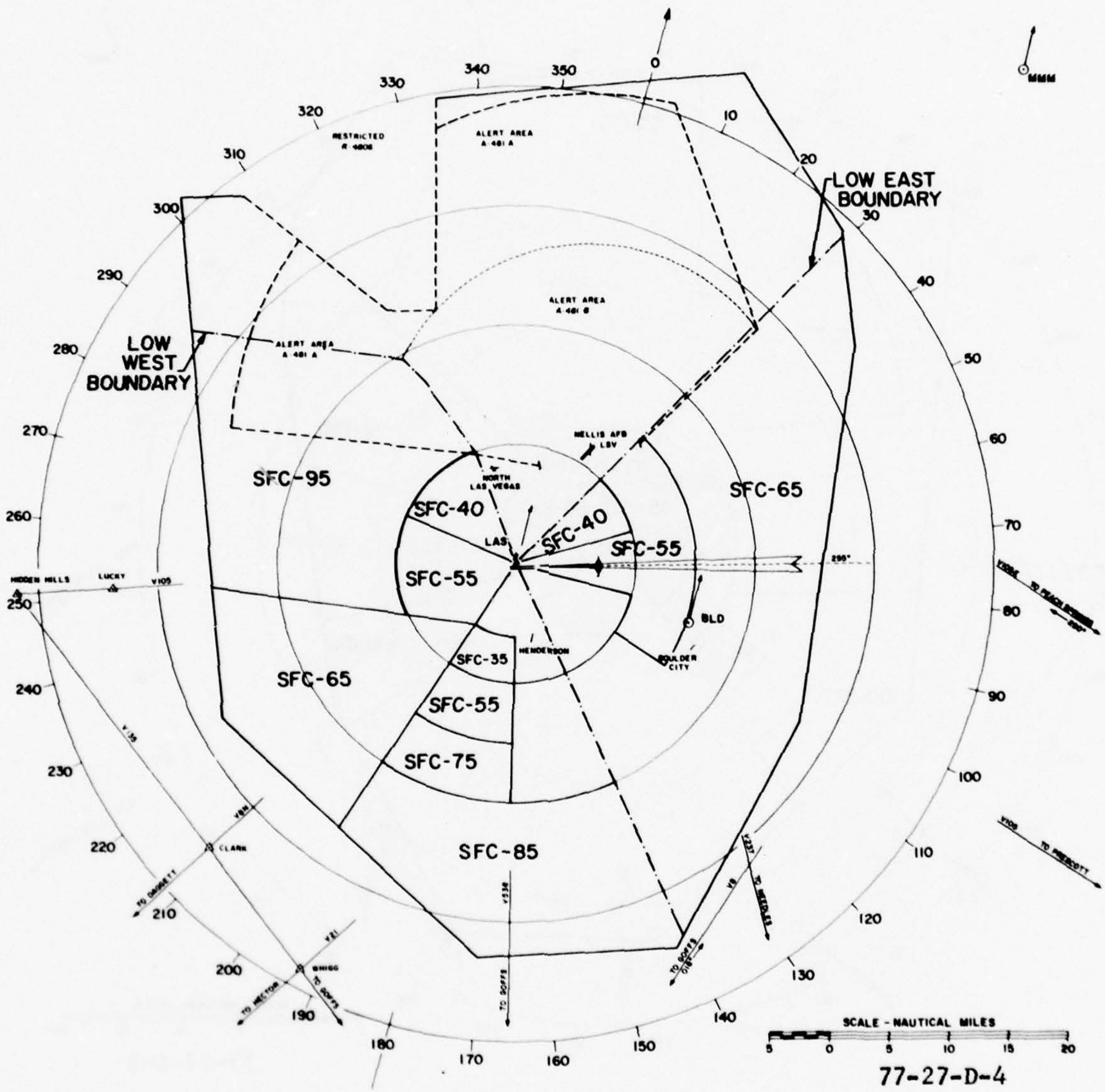


FIGURE D-4. SECTORIZATION CHART--LOW EAST AND LOW WEST CONTROLLER--RUNWAY 01

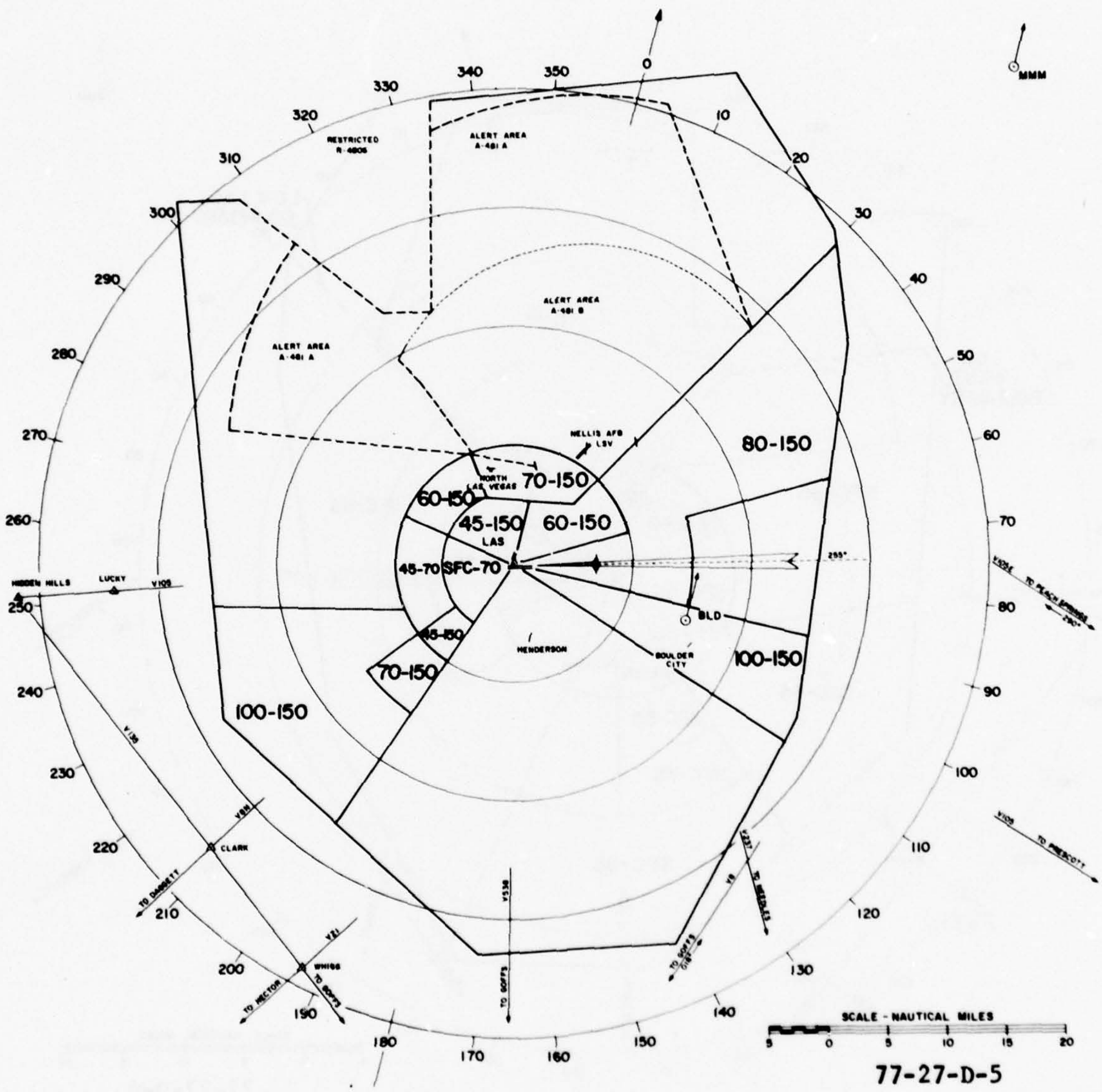


FIGURE D-5. SECTORIZATION CHART--DEPARTURE CONTROLLER--RUNWAY 25 AND 19

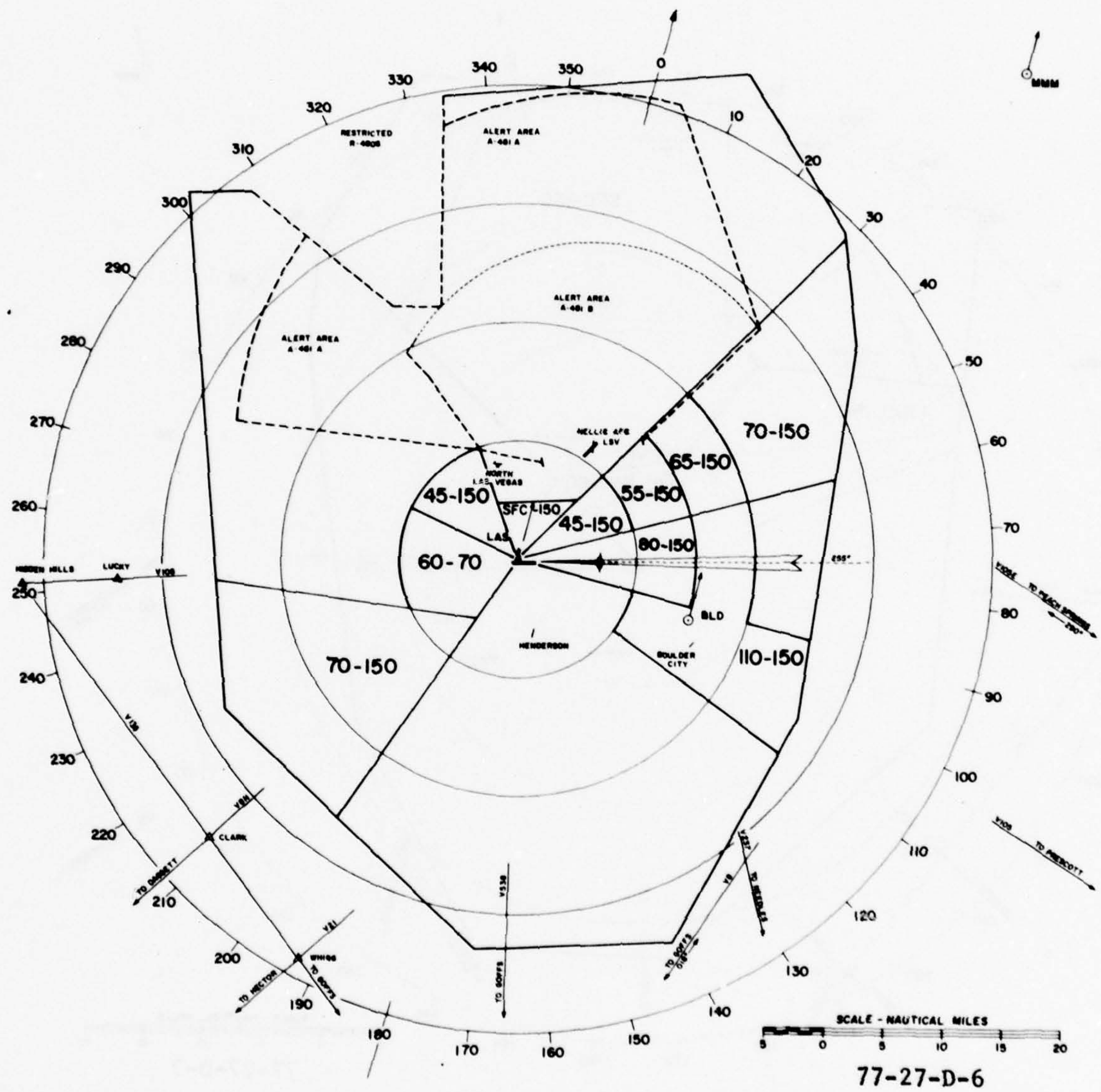


FIGURE D-6. SECTORIZATION CHART--DEPARTURE CONTROLLER--RUNWAY 01

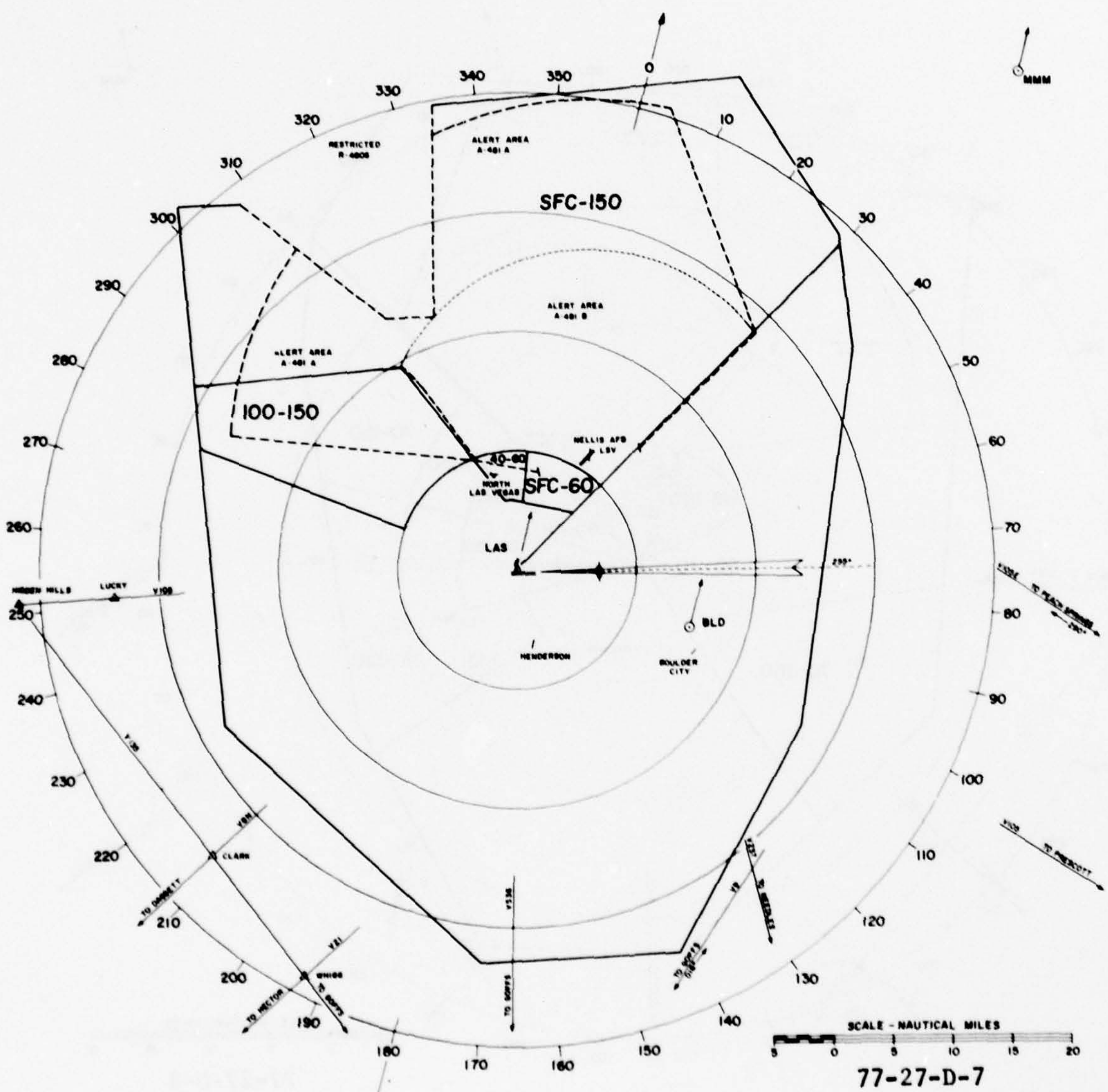


FIGURE D-7. SECTORIZATION CHART--NELLIS ARRIVAL AND DEPARTURE CONTROLLERS

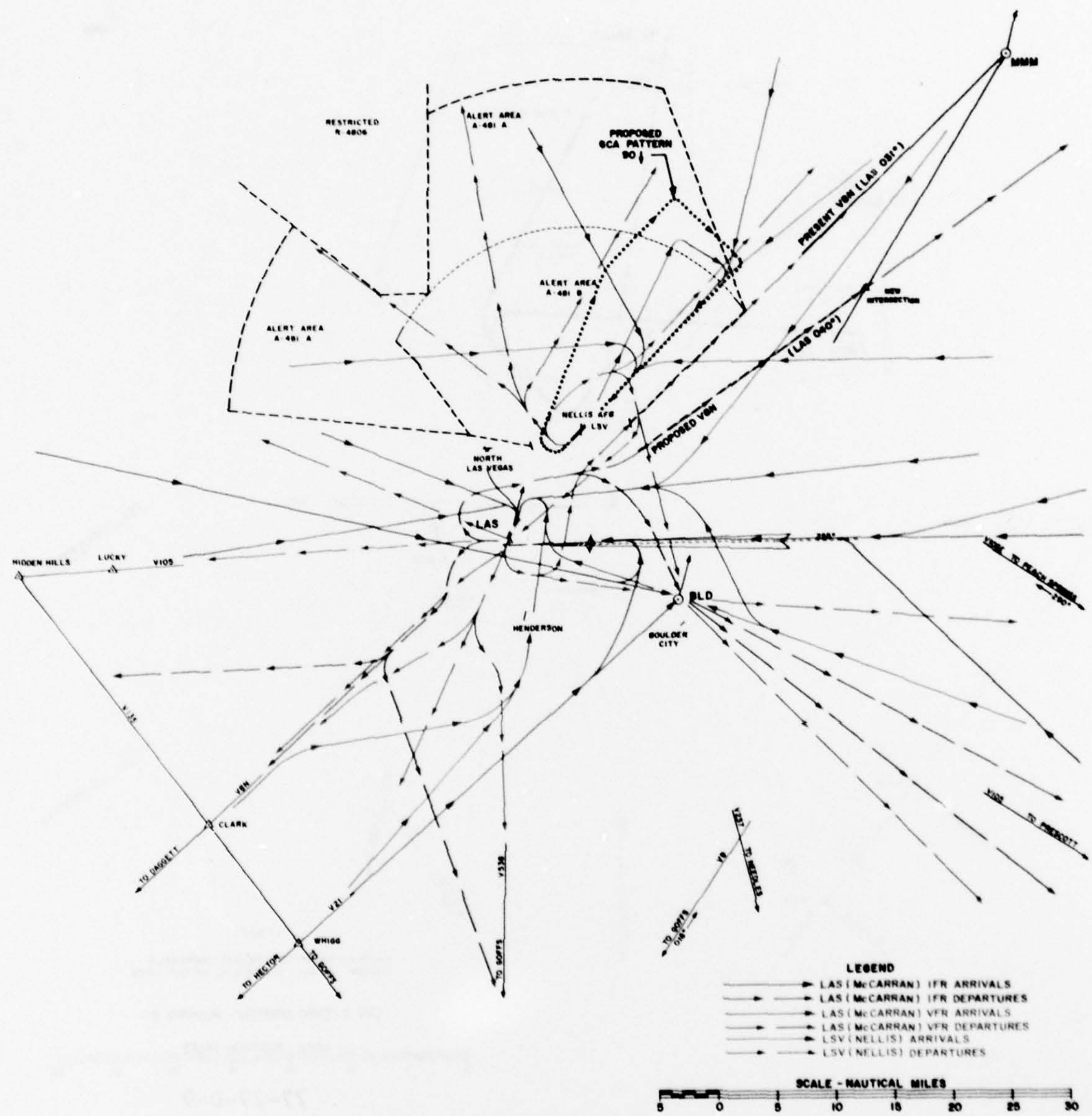


FIGURE D-8. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 21R/21L (CONFIGURATION 1)

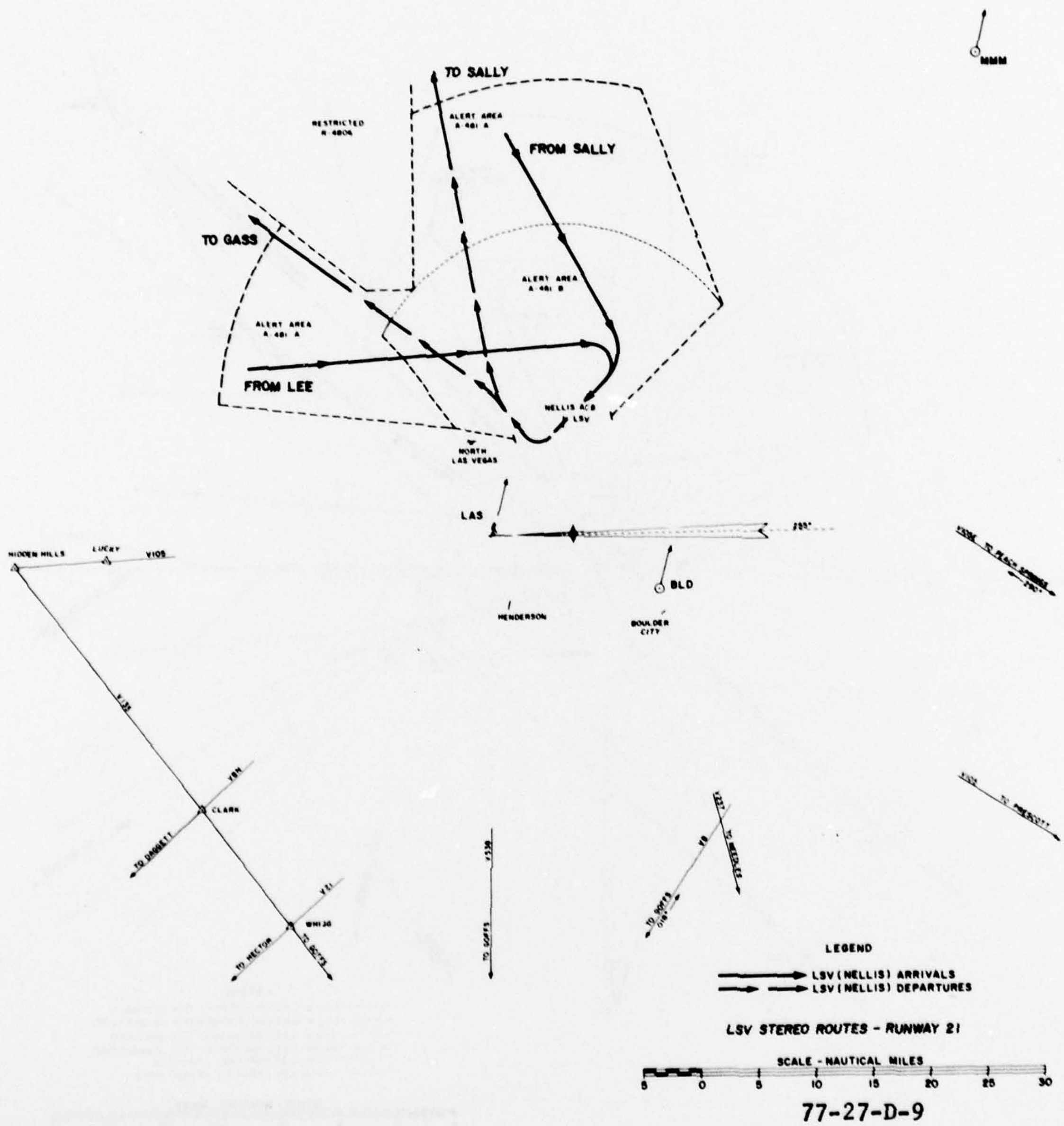


FIGURE D-9. NELLIS STEREO ROUTES--RUNWAY 21

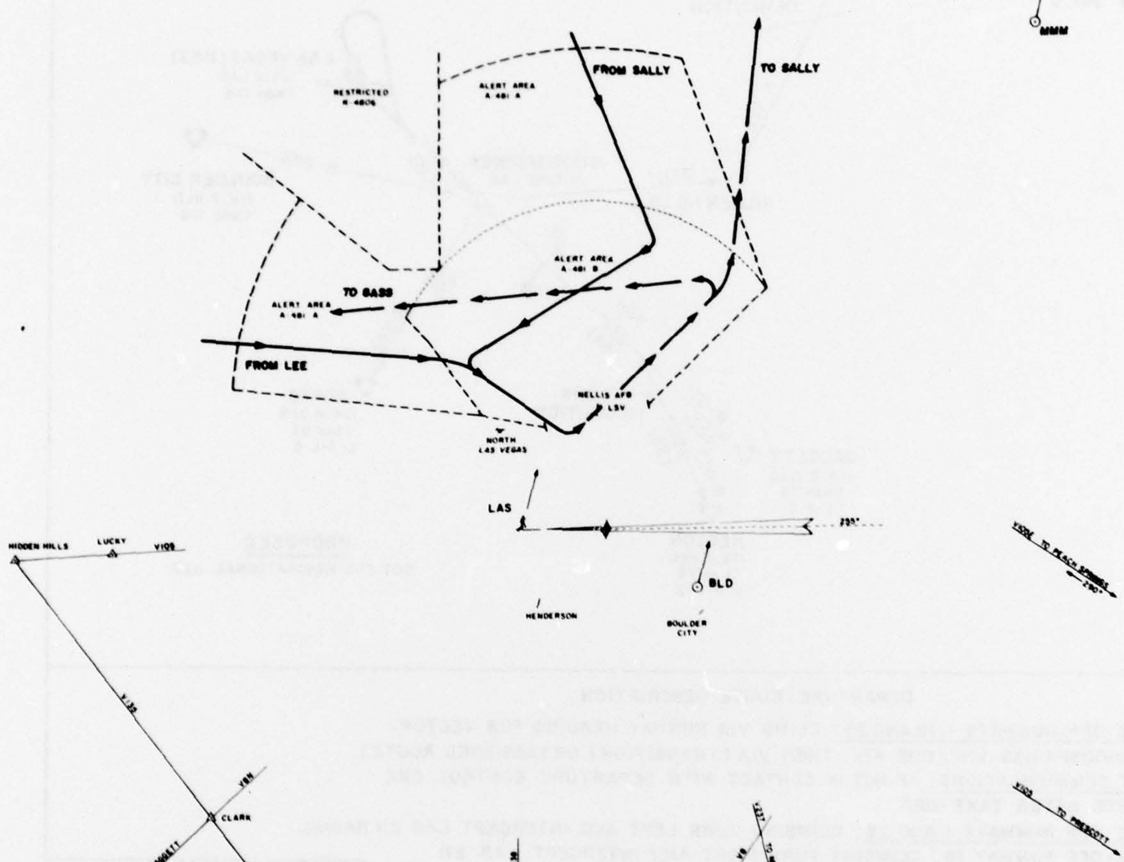
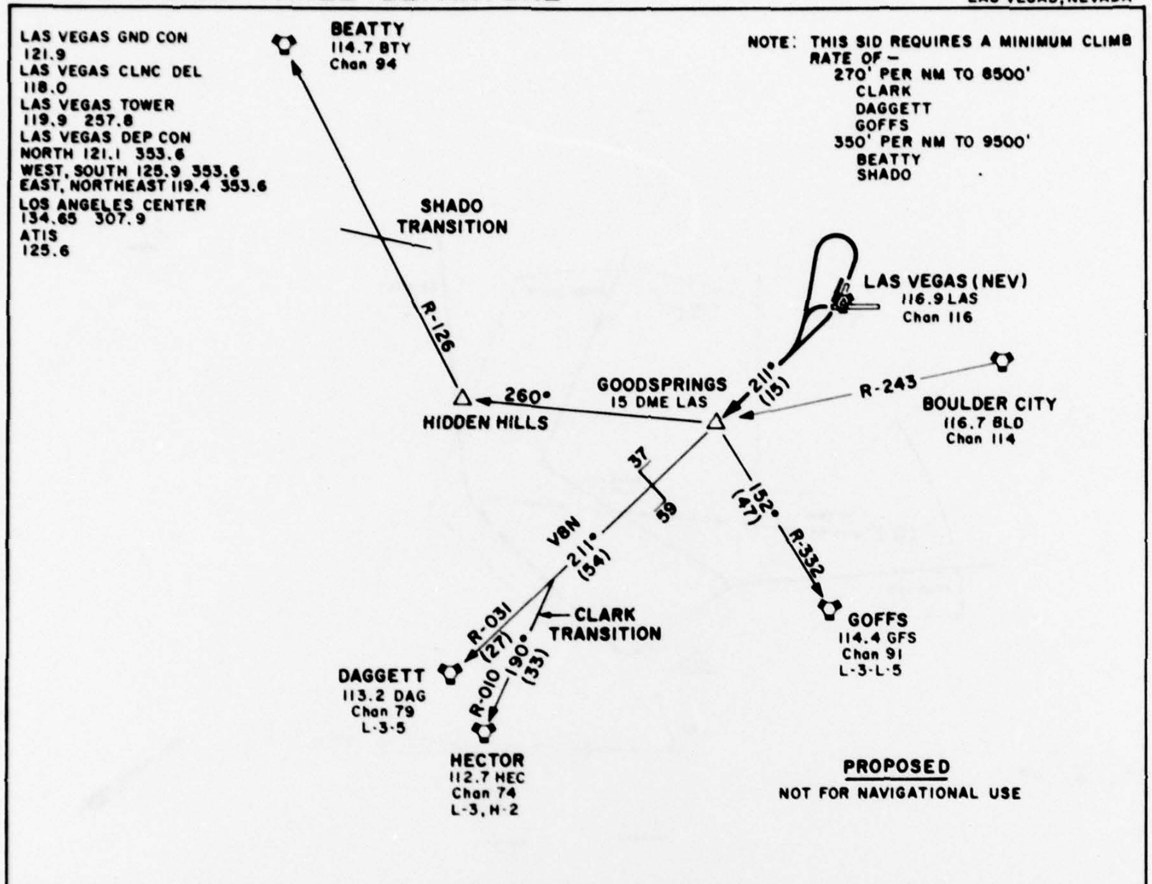


FIGURE D-10. NELLIS STEREO ROUTES--RUNWAY 03

GOODSPRINGS THREE DEPARTURE

MC CARRAN INTL
LAS VEGAS, NEVADA



DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RUNWAYS 1, 19 AND 25: CLIMB VIA RUNWAY HEADING FOR VECTOR TO GOODSPRINGS VHF/DME FIX. THEN VIA (TRANSITION) OR (ASSIGNED ROUTE)

LOST COMMUNICATIONS: IF NOT IN CONTACT WITH DEPARTURE CONTROL ONE MINUTE AFTER TAKE-OFF

TAKE-OFF RUNWAYS 1 AND 25: CLIMBING TURN LEFT AND INTERCEPT LAS 211 RADIAL

TAKE-OFF RUNWAY 19: CLIMBING TURN RIGHT AND INTERCEPT LAS 211 RADIAL

CLARK TRANSITION: VIA LAS VEGAS 211 AND DAGGETT 031 AND HECTOR 010 RADIALS TO HECTOR VORTAC

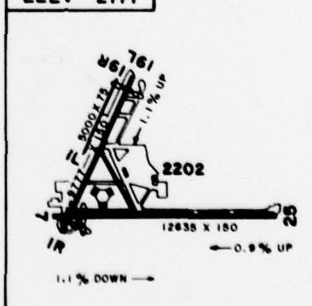
DAGGETT TRANSITION: VIA LAS VEGAS 211 AND DAGGETT 031 RADIALS TO DAGGETT VORTAC

GOFFS TRANSITION: VIA LAS VEGAS 211 AND GOFFS 332 RADIALS TO GOFFS VORTAC

BEATTY TRANSITION: AFTER PASSING 9500' AND GOODSPRINGS, CONTINUE CLIMB, TURN RIGHT 260° TO INTERCEPT AND PROCEED VIA BEATTY R-126 TO BEATTY VORTAC

SHADO TRANSITION: AFTER PASSING 9500' AND GOODSPRINGS, CONTINUE CLIMB, TURN RIGHT 260° TO AND PROCEED VIA BEATTY R-126 TO INTERCEPT J110

ELEV 2171



GOODSPRINGS THREE DEPARTURE

LAS VEGAS, NEVADA
MC CARRAN INTL

77-27-D-11

FIGURE D-11. PROPOSED GOODSPRINGS 3 SID (MCCARRAN INTERNATIONAL)

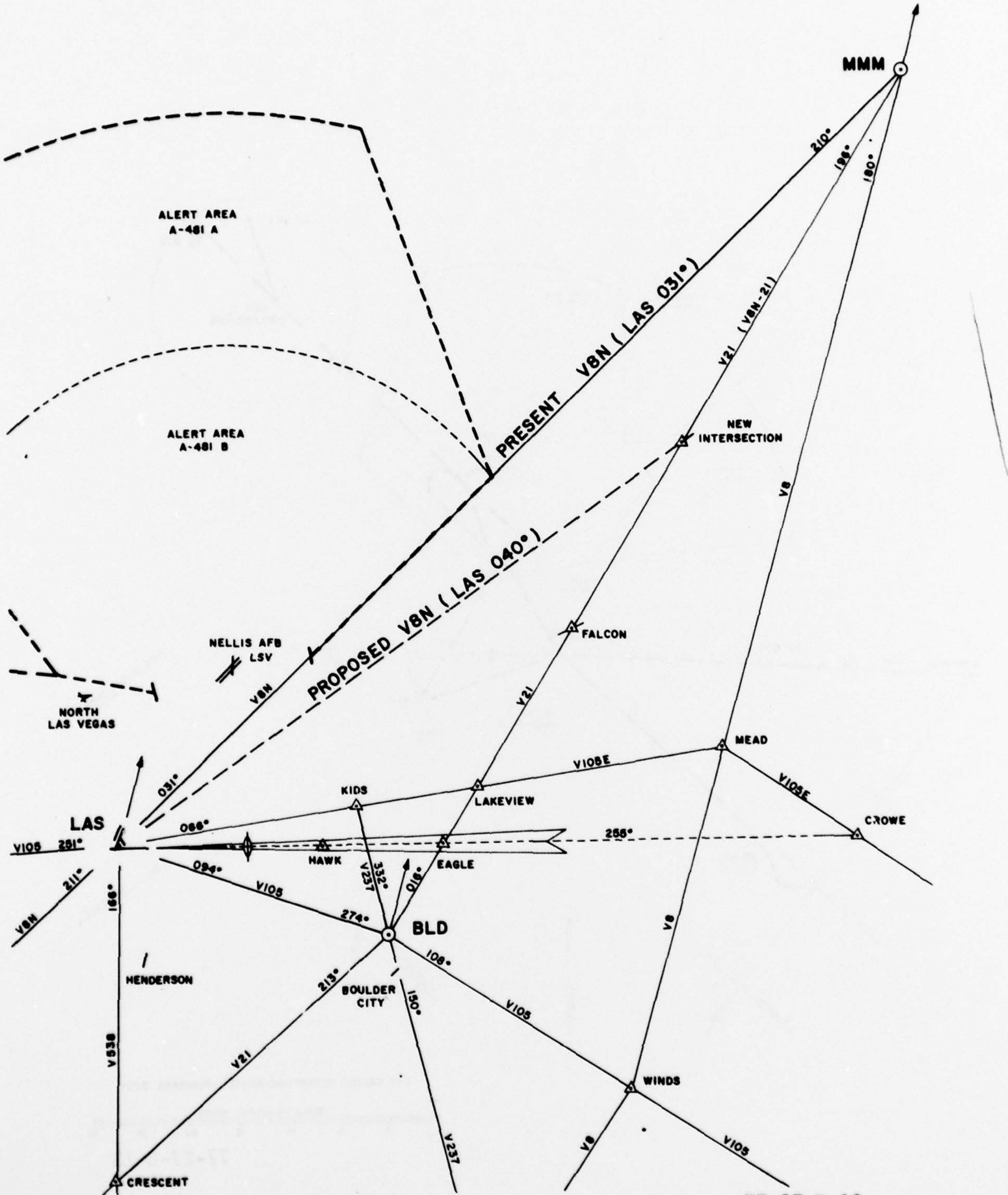


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FIGURE D-12. PROPOSED REALIGNMENT OF AIRWAY V8N

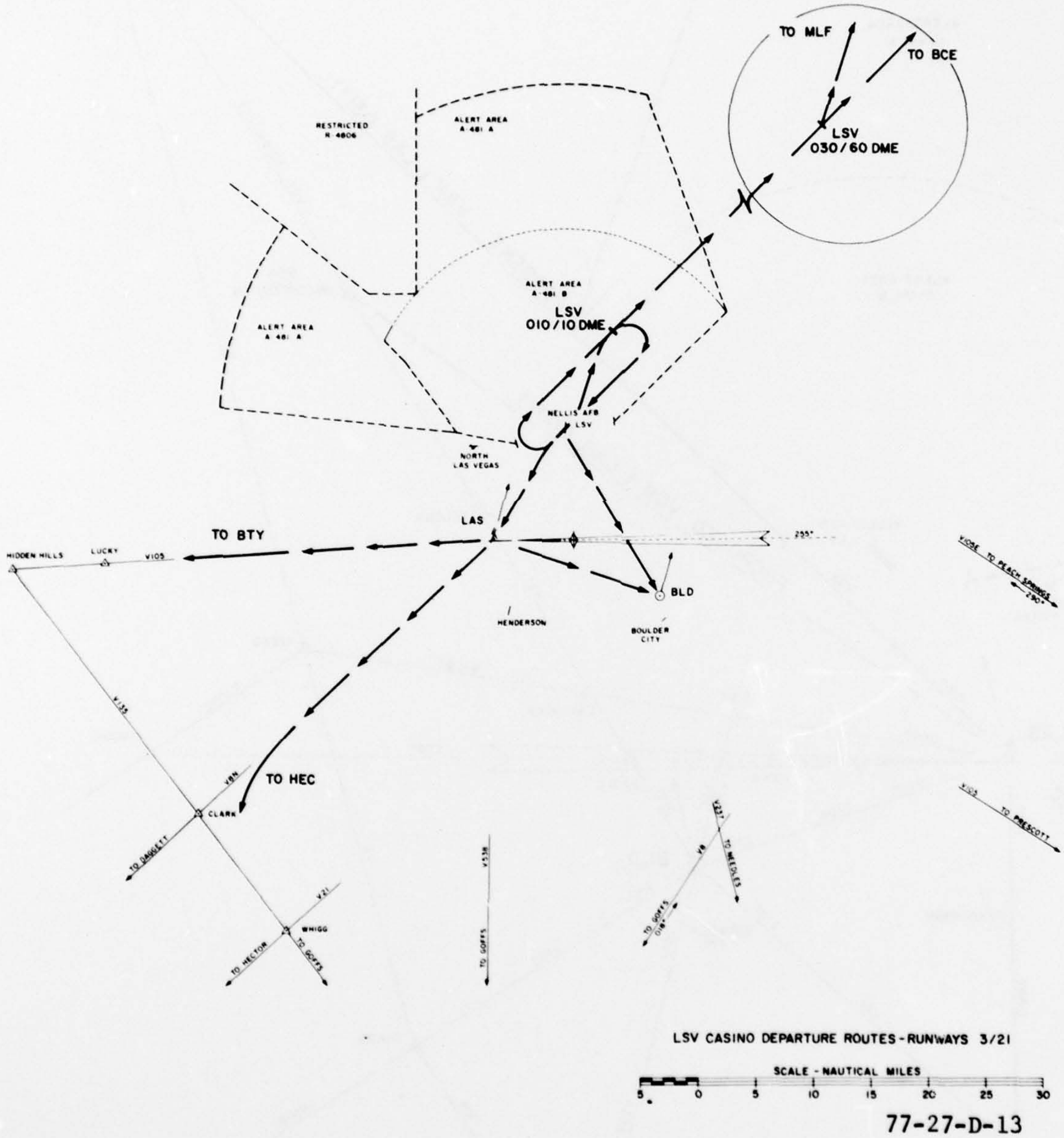

FIGURE D-13. PROPOSED NELLIS CASINO SID

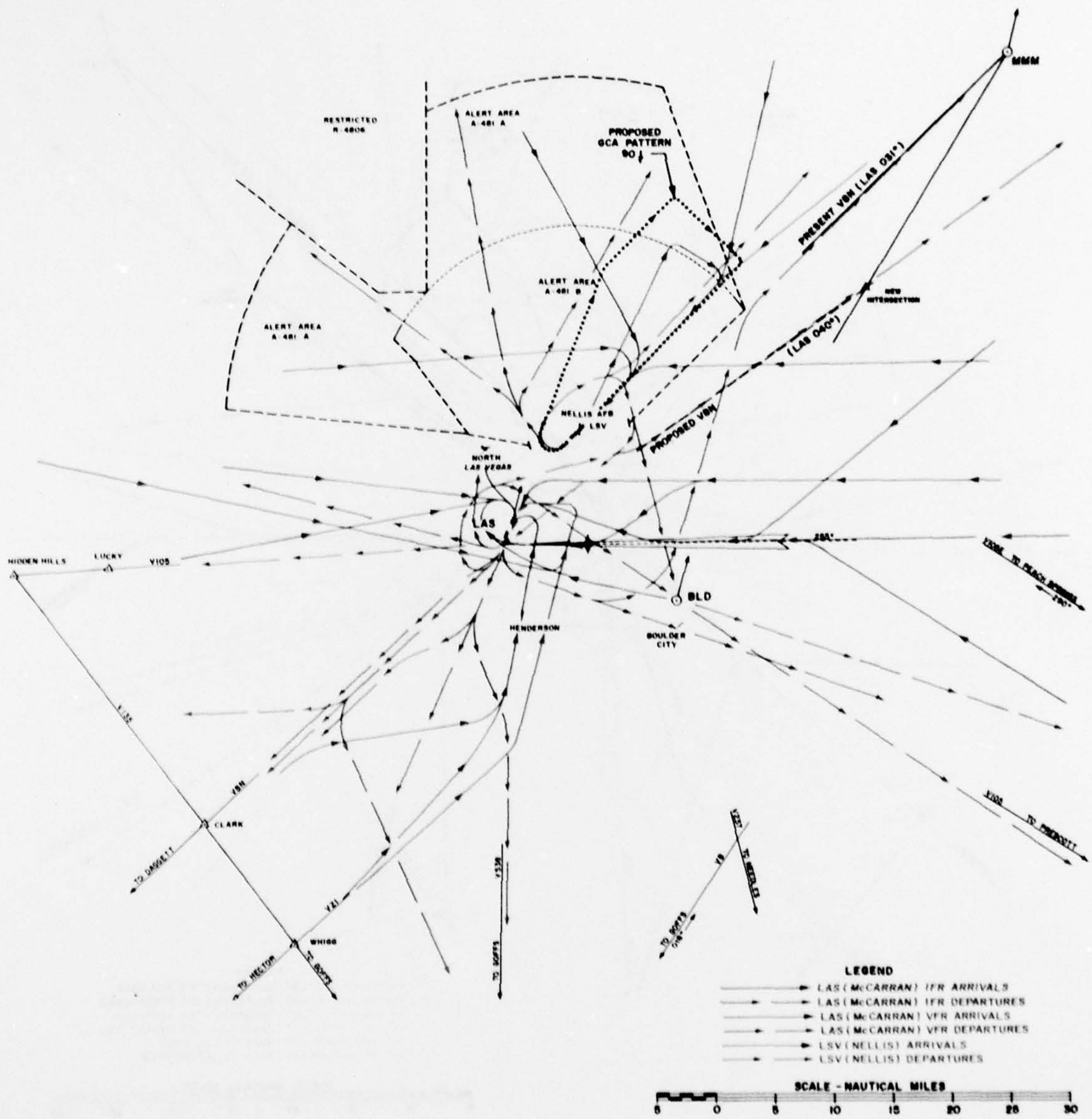

FIGURE D-14. FLOW CHART--LAS RUNWAYS 19R/19L, LSV RUNWAYS 21R/21L (CONFIGURATION 2)

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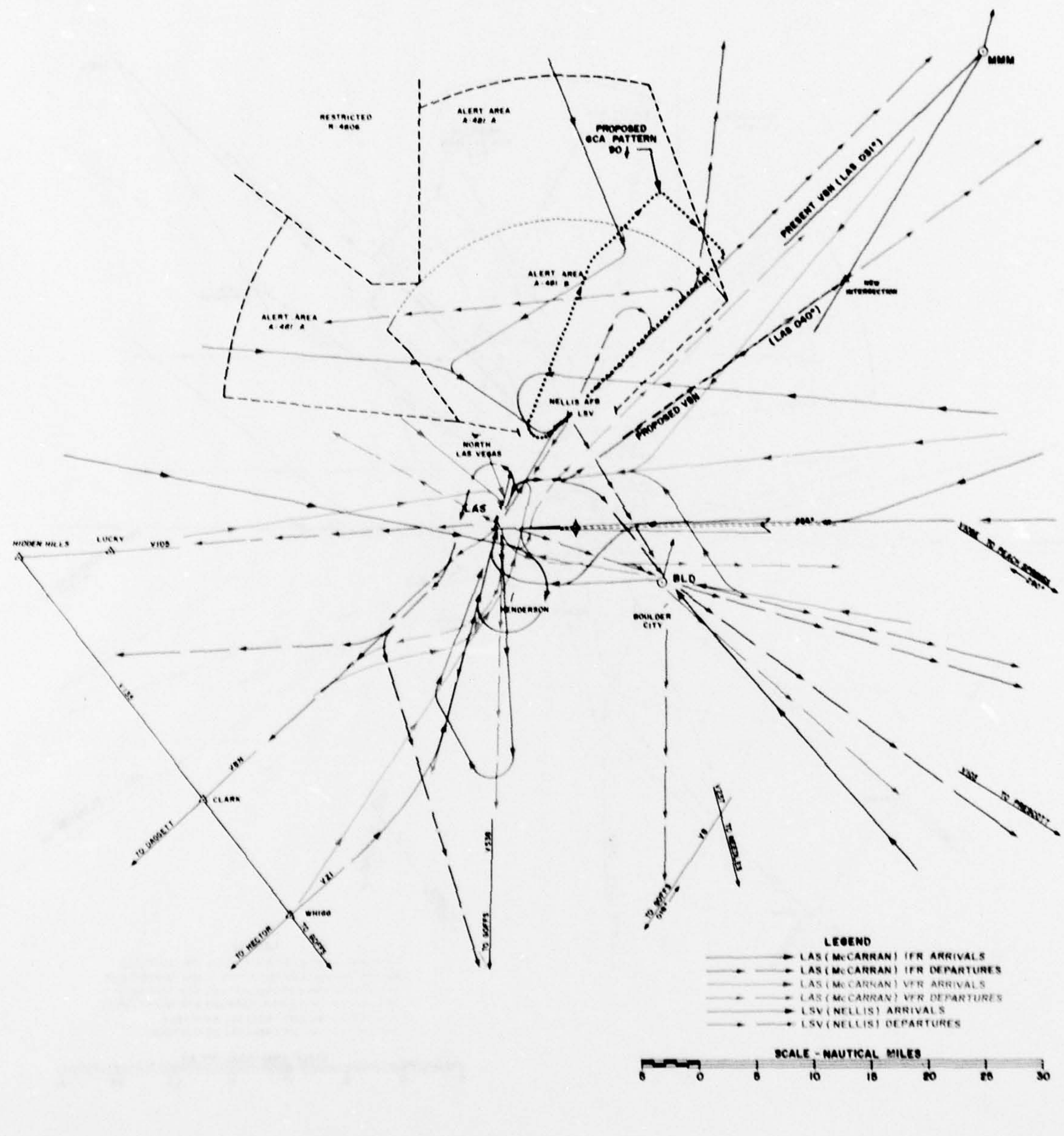


FIGURE D-15. FLOW CHART--LAS RUNWAYS 01R/01L, LSV RUNWAYS 03R/03L (CONFIGURATION 3)

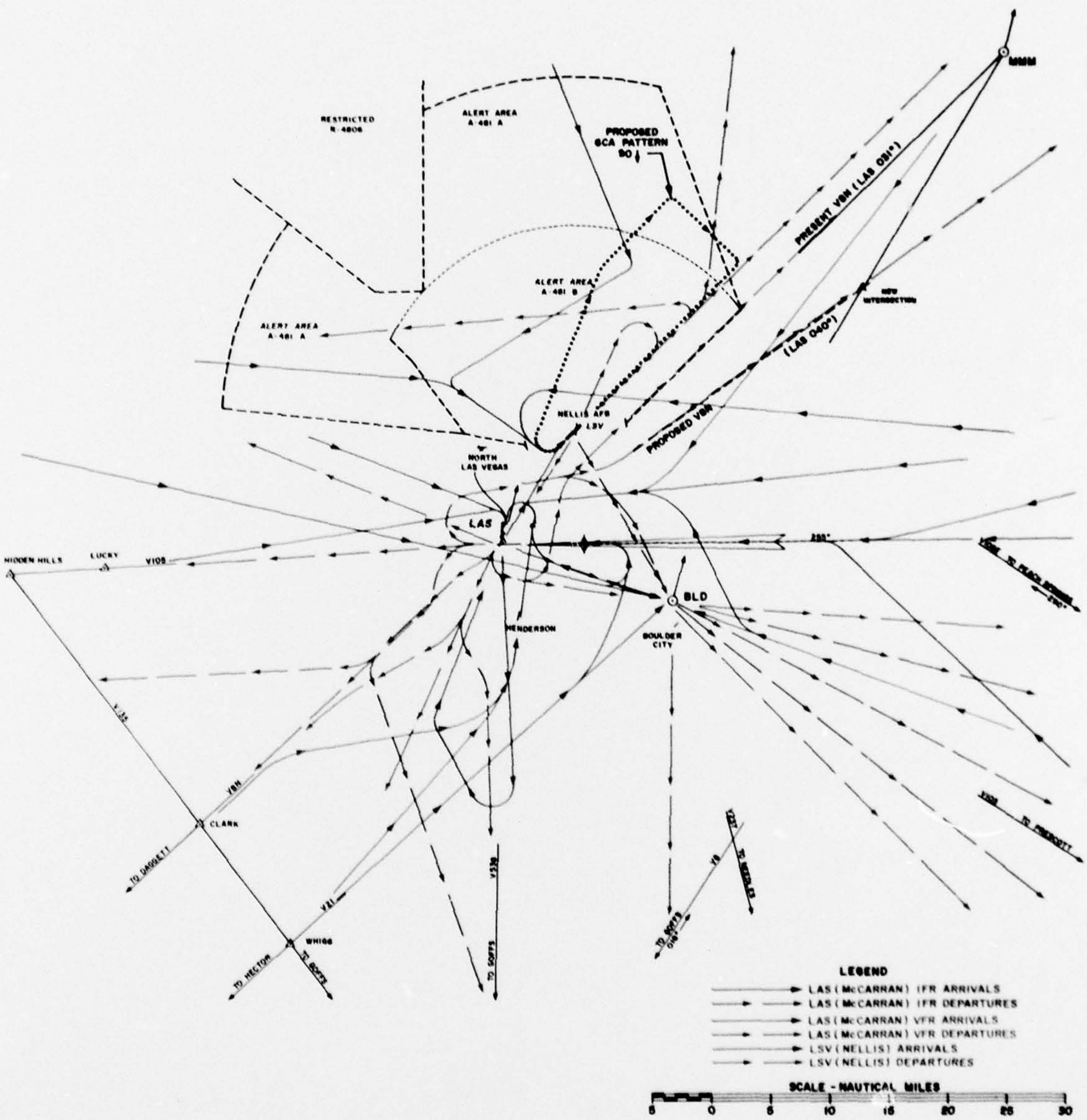


FIGURE D-16. FLOW CHART--LAS RUNWAYS 25/19, LSV RUNWAYS 03R/03L (CONFIGURATION 4)

APPENDIX E

PLAN 3 OPERATION, NELLIS AFB OPPOSITE DIRECTION TRAFFIC

PLAN 3 OPERATION, NELLIS AFB OPPOSITE DIRECTION TRAFFIC

GENERAL.

Nellis AFB does not have sufficient separation between runway centerlines to conduct simultaneous opposite direction traffic. Several possibilities exist, the safest of which is to separately handle arrivals then departures, but not at the same time.

Institution of any procedure involving an opposite direction operation will rely greatly on the effectiveness of Air Force Scheduling. Scheduling should attempt to create, as much as possible, a departure environment that will offer little conflict with arrivals, i.e., everyone departs and later everyone arrives. Some consideration was given to the idea of restricting arrivals and departures to a time frame, such as arrivals for a half hour then departures for a half hour. We felt this procedure did not allow flexibility (figure E-1).

In order to minimize delays, practice approaches and transition flying must be eliminated at Nellis during daylight hours. This type of operation exists at Williams AFB and Luke AFB in Arizona. We propose that this same type of operation be established for Nellis AFB at Indian Springs AF Aux Field. The success of this proposal hinges greatly on the relocation of these activities to Indian Springs.

TRAFFIC FLOW.

1. KRAIG ARRIVAL RUNWAY 21L

This route remains the same as the existing Sally recovery runway 21L, until the intersection of highway 93 and the south end of Hidden Valley. At this point, the route changes to: Turn right direct Kraig, cross Kraig at and maintain 4,500 feet. Turn left to pass between Nellis Tower and Sunrise Mountain. After passing Nellis Tower, a left descending turn to enter initial at 3,500 feet for left traffic runway 21L.

2. APEX DEPARTURE RUNWAY 03

Depart runway 03 direct Dry Lake (LSV 013/16), cross Dry Lake at or above 9,000 feet. Turn left direct, for either Gass or ROX transition.

3. IFR DEPARTURES

All aircraft depart on published SID's from runway 03.

4. IFR ARRIVALS

There would be few of these, because the only aircraft utilizing these procedures would be transient aircraft. There would be a slight increase in coordination, because Nellis Tower would have to be notified in sufficient time

to eliminate confliction, and at this time, the LSV Tower controller automatically calls for release for all departures until Nellis Tower has landing assured.

5. HOLDING

1. Transient arriving aircraft can utilize existing published holding patterns.

2. Stereo recoveries hold north of Gass Peak between 12,000 and 15,000 feet (LSV 295/13).

SUMMARY.

1. What has been established appears to be a straight runway 03 traffic flow.

2. It will be the responsibility of Nellis Tower to maintain visual separation between those arrivals and departures that overlap.

3. A VFR holding pattern has been established when too many arrivals overlap departures, and departures take precedence.

4. As far as Las Vegas Approach Control is concerned, the routes that will be flown are separated and can be shortened on request after contact with departure control, traffic permitting.

5. Arrival routes have been established the same to Hidden Valley for all runway configurations. This provides continuity to all arrival operations and allows approach control the flexibility to change to a straight runway 21 operation should the situation dictate.

6. Once again, the success of the operation depends upon the alleviation of traffic in the Nellis area by relocation of some operations to Indian Springs.

INDIAN SPRINGS AF AUX.

Indian Springs Auxiliary Airfield is located approximately 38 nmi west northwest of Nellis AFB. Its mission is primarily an emergency divert base for aircraft operating in the surrounding training ranges and by the USAF Thunderbirds Aerial Demonstration Team as a practice area.

A 7,600 by 150 foot usable runway exists with no NAVAID's at this time. It does have an operational control tower, fire station, and almost all facilities to support a normal airfield operation. There was an operational TACAN as recently as 1 year ago during the BOLD EAGLE exercise. There is room for lengthening the runway at the approach end should this be desirable.

Indian Springs borders restricted area R-4806. Initiating a GCA pattern and TACAN approach south and west of the airport, most of the restricted area can be avoided, thus having little impact on range activity within the area.

This would require installation of a mobile GCA unit and a TACAN. VFR traffic and GCA patterns would not conflict with Las Vegas traffic, because they could be conducted below usable area for Las Vegas. A TACAN penetration, when established, would more than likely be run by Las Vegas Approach. A straight-in approach from 30 nmi and 15,000 feet at initial approach would have little effect on the traffic at Las Vegas except for the additional coordination required.

REASONS FOR RELOCATION OF ACTIVITIES TO INDIAN SPRINGS.

1. Flying Safety

a. By conducting practice approaches and touch-and-goes at Indian Springs it will lessen congestion within the Las Vegas area.

b. Any form of an opposite direction operation cannot be conducted under existing conditions.

2. Noise Abatement

Noise and those aircraft departing Nellis with live ordinance were the prime considerations for initiating this type operation.

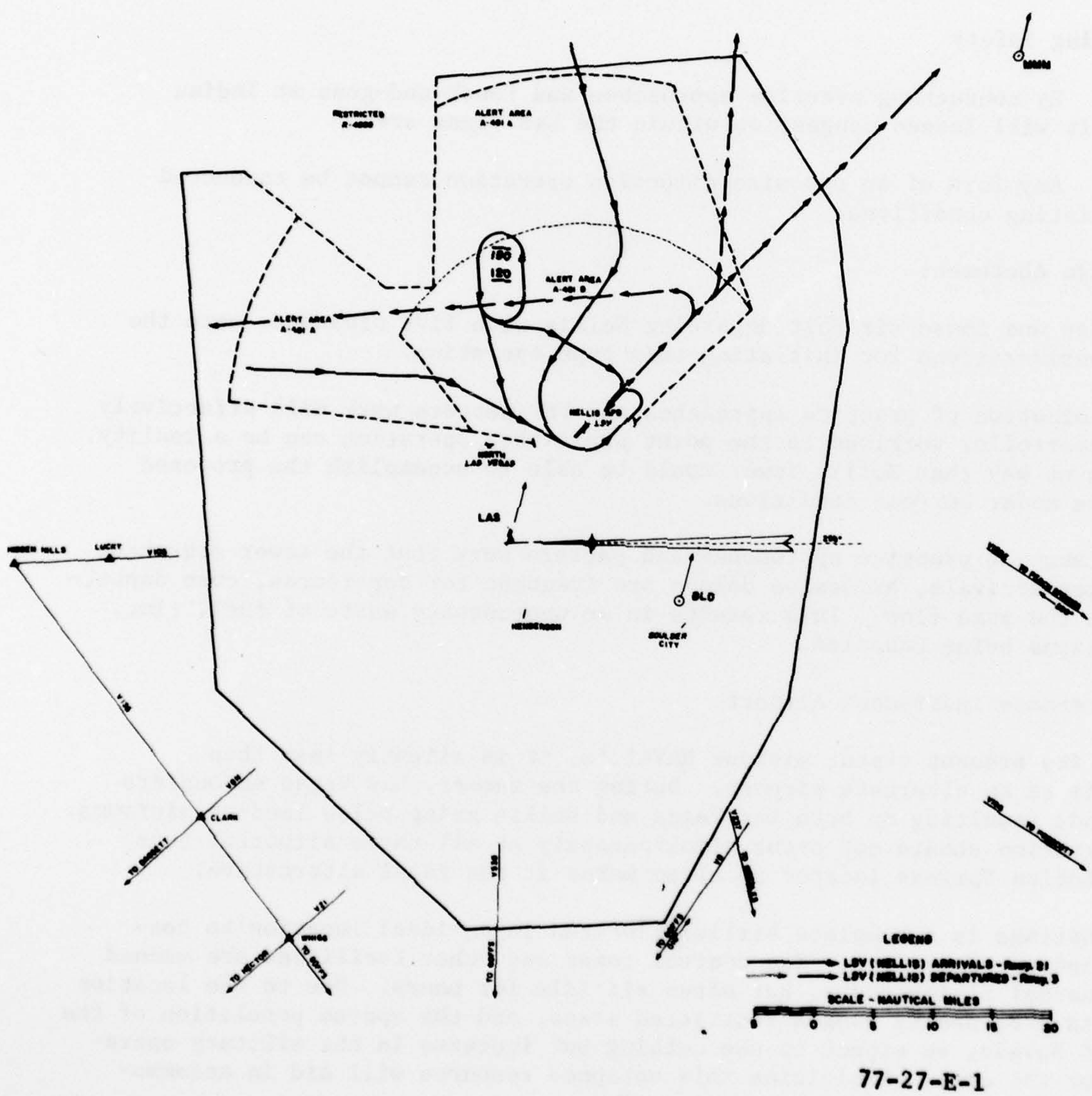
3. Elimination of practice approaches and VFR pattern work will effectively reduce controller workload to the point where this operation can be a reality. There is no way that Nellis Tower could be able to accomplish the proposed objective under current conditions.

4. Because of practice approaches and pattern work that the tower sequences with other arrivals, excessive delays are frequent for departures, even departing with the same flow. This results in an unnecessary waste of fuel, time, and missions being canceled.

5. Alternate Instrument Airport

In its present state, without NAVAID's, it is slightly less than desirable as an alternate airport. During the summer, Las Vegas encounters high winds resulting in both Las Vegas and Nellis going below landing minimums. This situation should not occur simultaneously at all three airports, thus having Indian Springs located so close makes it the ideal alternative.

Indian Springs is a complete airfield located in an ideal location to conduct proposed operations. The control tower and other facilities are manned during normal flying hours, but often sit idle for hours. Due to the location of Nellis AFB, nearby ranges restricted areas, and the sparse population of the state of Nevada, we expect to see nothing but increase in the military operations for the area. Exploiting this untapped resource will aid in accommodating anticipated traffic for Nellis AFB.



77-27-E-1

FIGURE E-1. LSV (NELLIS) DEPARTURE RUNWAY 3--ARRIVALS RUNWAY 21 FLOW CHART